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August 1, 1971

August 1, 1971

STANDARD DRAWING BOOK

We are sending the following additions and/or revisions effective August 1, 1971 to be included in your present Standard Drawing Book, the grey covered one, original issue January 1, 1969.

39-14(A)✓	Standard Concrete Approach Slabs to Structures
39-14(B)✓	Standard Concrete Approach Slabs to Structures
39-14(C)✓	Standard Concrete Approach Slabs to Structures
39-15(A)✓	Standard Concrete Approach Slabs to Structures With U-Type Abutments
39-15(B)✓	Standard Concrete Approach Slabs to Structures With U-Type Abutments
50-21(A)✓	Concrete Slope Protection-Alternate II
50-21(B)✓	Concrete Slope Protection-Alternate II
88-08✓	R4-12, R4-13, R10-8
88-16✓	Standard W4-2 Warning Sign
88-56✓	Typical Approach Road Signing
88-57✓	Typical Sign Erection
88-91✓	Delineators Type I
88-92✓	Delineator Spacing For Horizontal Highway Curves
90-03✓	Metal Median Rail
90-04(A)✓	Bridge End Treatment (Steel Guard Rail - Bridge Approach Section with Concrete Posts)

The following Standard Drawings are deleted from your present Standard Drawing Book and should be destroyed.

50-20(A)✓	Concrete Slope Protection
50-20(B)✓	Concrete Slope Protection
50-20(C)✓	Concrete Slope Protection

NOTE: 1. Add these drawings to your book
 2. We are also sending new index pages 2, 6 and 7.
 You should destroy old index pages 2, 6 & 7.

filed 8/1/71

J. V. O'Donnell
J. V. O'DONNELL
Director of Contract Plans

MONTANA STATE LIBRARY
930 East Lyndale Avenue
Helena, Montana 59601

39-14(A) Standard Concrete Approach Slabs to Structures
 Added Effective 4-1-70
 Revised Effective 4-15-71

39-14(B) Standard Concrete Approach Slabs to Structures
 Added Effective 4-1-70
 Revised Effective 4-15-71

39-14(C) Standard Concrete Approach Slabs to Structures
 Added Effective 4-15-71

39-15 Standard Concrete Approach Slabs to Structures with
U-Type Abutments
 Added Effective 1-1-70
 Deleted as of 4-1-70

39-15(A) Standard Concrete Approach Slabs to Structures with
U-Type Abutments
 Added Effective 4-1-70
 Revised Effective 4-15-71

39-15(B) Standard Concrete Approach Slabs to Structures with
U-Type Abutments
 Added Effective 4-1-70
 Revised Effective 4-15-71

41-01 Box Culvert Data - Reference

41-05 Box Culvert Data - Reference

50-01 Culvert Riprap

50-01 Culvert Riprap
 Revised Effective 1-1-70

50-02 Grouted Riprap

50-03 Riprap Quantities

50-04 Embankment Protection

50-05 Concrete Drainage Chute
 Added Effective 7-1-69
 Revised Effective 4-1-70

50-20 Concrete Slope Protection
 Deleted as of 1-1-71

50-20(A) Concrete Slope Protection
 Added Effective 1-1-71

50-20(B) Concrete Slope Protection
 Added Effective 1-1-71

50-20(C) Concrete Slope Protection
 Added Effective 1-1-71

50-21 Concrete Slope Protection - Alternate II
 Deleted as of 1-1-71

50-21(A) Concrete Slope Protection - Alternate II
 Added Effective 1-1-71

50-21(B) Concrete Slope Protection - Alternate II
 Added Effective 1-1-71

51-01 Metal Bin - Type Retaining Wall

51-02 Concrete Crib Retaining Wall

51-03 Backfill Retainer and Cutoff Wall for Vehicular Underpass
 Revised Effective 4-1-70

54-01 Culvert Bedding
 Deleted as of 1-1-71

54-01 RCP Culvert Bedding
 Added Effective 1-1-71

54-02 Typical Field Cast Concrete Bend RCP To CMP Connection Detail

54-03 Bedding Material
 Revised Effective 1-1-70
 Revised Effective 4-1-70

54-04 Filter Material for Underdrains

54-05 Syphon Pipe

- 88-07 Standard R2-12 Sign
Added Effective 1-1-71
- 88-08 R4-12, R4-13, R10-8 and R10-9
- 88-09 Signing of Median U-Turns
Revised Effective 1-1-70
Revised Effective 1-1-71
- 88-10 Standard R2-8 Signs
- 88-11 R4-14 and R4-15
- 88-12 R4-9
- 88-16 Standard W4-2 Warning Sign
Revised Effective 1-1-71
- 88-17 W6-4, W6-5, W12-3 and X3-2 Warning Signs
- 88-18 W6-4A and W6-4B
Revised Effective 1-1-71
- 88-19 W8-9, W9-2, W9-5 and W9-6 Warning Signs
Revised Effective 1-1-71
- 88-26 Interstate Business Shields
- 88-27 Primary Route Marker for Use on Guide Signs
- 88-28 Secondary Route Marker for Use on Guide Signs
Revised Effective 1-1-71
- 88-29 Standard M1-6 and M1-7 Route Markers
- 88-36 Typical Guide Sign Layout
Revised Effective 1-1-71
- 88-37 Informational Signs
Deleted as of 1-1-71
- 88-37 Informational Signs - Services
Added Effective 1-1-71
- 88-37 A Informational Signs - Rest Area
Added Effective 1-1-71
- 88-38 Standard N6-2 Stream Name Sign
Deleted as of 1-1-71
- 88-38 Standard N6-2 Stream Name Sign Primary and Secondary Routes
Added Effective 1-1-71
- 88-39 Weigh Station Signs
Revised Effective 7-1-69
Revised Effective 1-1-71
- 88-47 Standard Rest Area and Information Signs
Revised Effective 1-1-71
- 88-48 Informational Signs
- 88-56 Typical Approach Road Signing
Revised Effective 1-1-70
- 88-57 Typical Sign Erection
Revised Effective 1-1-71
- 88-58 Typical Crossroad and Ramp Layout
Revised Effective 1-1-70
Revised Effective 1-1-71
- 88-59 Typical Guide Sign Placement
Revised Effective 1-1-70
- 88-66 Standard Guide Signs
Revised Effective 1-1-71
- 88-67 Guide Sign Placement
- 88-68 Aluminum Sheet Increment Guide Signs
Revised Effective 1-1-71
- 88-69 Plywood Sheet Increment Guide Signs
- 88-70 Guide Sign Mounting Details
Revised Effective 1-1-71

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88-71	Railroad Crossing Signs
88-72	Railroad Crossing Signs Revised Effective 1-1-71
88-73	Interstate and Primary Mileposts
88-74	X1-1 Sign and Erection Detail Revised Effective 1-1-70 Revised Effective 1-1-71
88-75	Typical Pipe Post Mounting Detail Revised Effective 1-1-71
88-76	Wood Pole Slot Detail Revised Effective 1-1-71
88-77	Typical Sign Erection Revised Effective 1-1-71
88-78	Typical Route Marker Assembly with Treated Timber Post Revised Effective 1-1-71
88-79	Typical Route Marker Assembly with Treated Timber Pole
88-80	Typical Route Marker Assemblies with Steel Posts
88-81	Typical Sign Erection - Steel Posts
88-91	Delineators Deleted as of 7-1-69
88-91	Delineators Type I Added Effective 7-1-69
88-91 A	Delineators Type II Added Effective 7-1-69
88-92	Delineator Spacing for Horizontal Highway Curves Revised Effective 1-1-70 Revised Effective 1-1-71
90-00	5" Guide Posts Added Effective 1-1-71
90-01	Wood Guide Posts
90-02	Metal Guard Rail Revised Effective 7-1-69 Revised Effective 1-1-71
90-02 A	Metal Median Rail Deleted as of 1-1-71
90-03	Standard Guard Rail Anchor Section Deleted as of 1-1-71
90-03	Metal Median Rail Added Effective 1-1-71
90-04	2-Lane, 2-Way Bridge End Treatment Deleted as of 1-1-71
90-04	Bridge End Treatment (Steel Guard Rail - Bridge Approach Sections) Added Effective 1-1-71 Revised Effective 1-1-71
90-05	Multi-lane Bridge End and Bridge Pier Treatment Revised Effective 7-1-69 Deleted as of 1-1-71
90-05	Guard Rail Terminal Sections - Sheet 1 Added Effective 1-1-71
90-06	Guard Rail Terminal Sections - Sheet 2 Added Effective 1-1-71
* 90-06	Cable Guard Rail Change this Drawing No. to 90-20

REVISED
EFFECTIVE3-6-70
4-1-703-9-71
4-15-71

STANDARD DRAWING NO. 39-14 (A)

STATE HIGHWAY COMMISSION
HELENA, MONTANASTANDARD CONCRETE APPROACH
SLAB TO STRUCTURESApproved by:
Louis M. Buttler H.P.E.
STATE HIGHWAY ENGINEER

For Details Of Type 1 or Type 2 Joint Thru Slab Section, See Std. Dwg. 39-14 B And Section "CC" This Sheet.

Type 1 joint for rigid abut.
Type 2 joint for moveable abut.
(For Type Required See "General Layout" On Bridge Plans.)

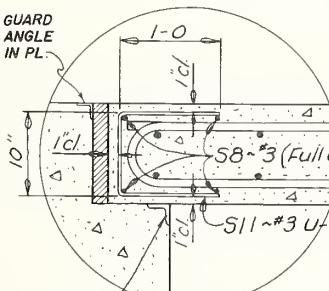
GUARD ANGLE IN PL.

18" Wide layer of 30# tar-paper (Full length of paving notch) (Lap over 9" onto subgrade.)

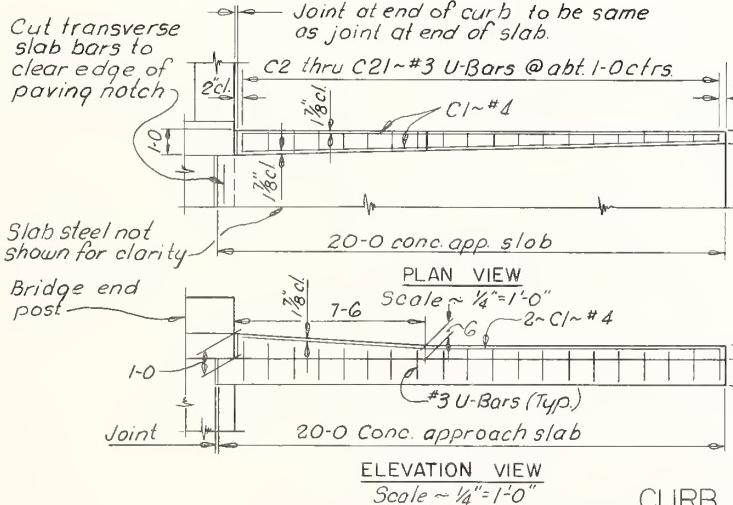
Type No. 2 Filter Material. (See Std. Spec. M100-12) (Place full length of 6" drain.)

Bridge Abutment

See Detail "J"

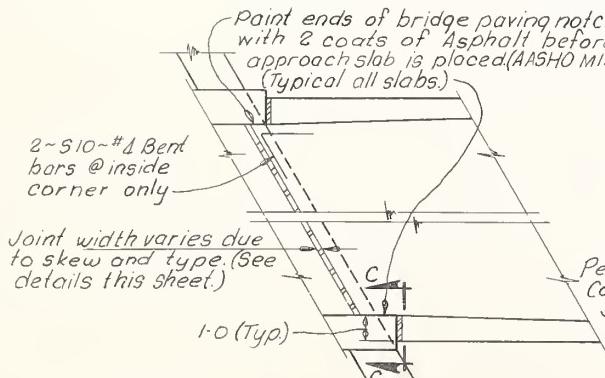
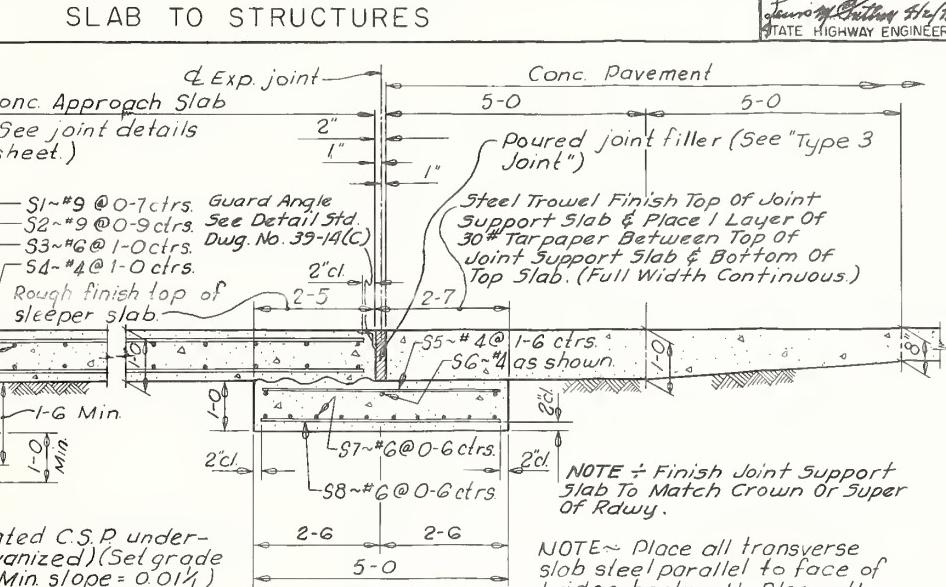
DETAIL "J"
Scale ~ 1" = 1'-0"

Guard Angle Required For Type 2 Joint Only.

ELEVATION VIEW
Scale ~ 1/4" = 1'-0"

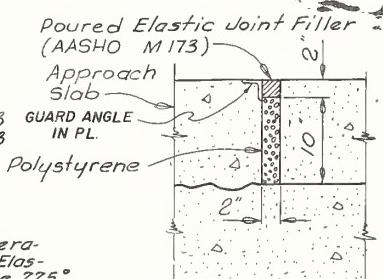
Scale ~ 1/4" = 1'-0"

Scale ~ 1/4" = 1'-0"

CURB END DETAILS
AT SKEWED BRIDGE
Scale ~ 1/4" = 1'-0"

NOTE ~ Finish Joint Support Slab To Match Crown Or Super Of Rdwy.

NOTE ~ Place all transverse slab steel parallel to face of bridge backwall. Place all longitudinal slab steel parallel to & Rdwy.



TYPE 3 JOINT

NOTE: Application Temperature of AASHTO M173-60 Elastic Joint Sealer Shall Be 225° Plus Or Minus 10° Maximum.

NOTE: Approach Slab And Curb Shall Be Given A Protective Coating Of Boiled Linseed Oil. See Standard Specifications

Scale 1" = 1'-0"

REVISED 3-6-70 3-9-71
EFFECTIVE 4-1-70 4-15-71

STANDARD DRAWING NO. 39-14(B)

STATE HIGHWAY COMMISSION
HELENA, MONTANA

STANDARD CONCRETE APPROACH SLAB TO STRUCTURES

Approved by:
State Highway Engineer
4-14-71
STATE HIGHWAY ENGINEER

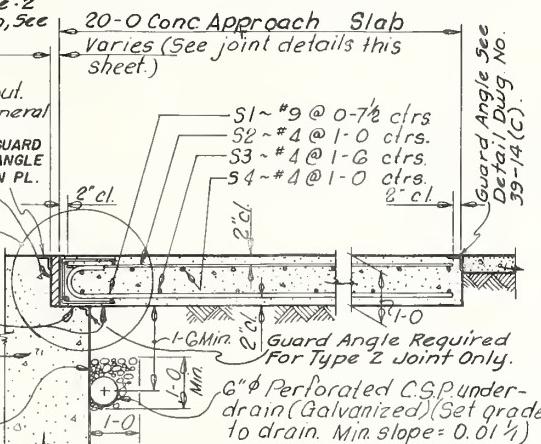
For Details Of Type 1 Or Type 2 Joint Through Curb Section, See
Std. Dwg. No. 39-14(A).

Type 1 joint for rigid abut.

Type 2 joint for moveable abut.
(For Type Required See "General
Layout" On Bridge Plans.)

Detail "J"
(See Std Dwg. No. 39-14(A))
18" Wide layer of 30#
paper (Full length of
paving notch) (Lap over
9" onto subgrade)

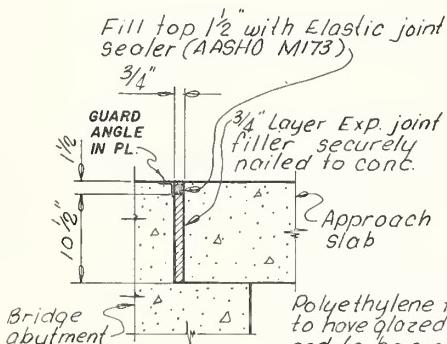
Bridge abutment
Type No. 2 Filter Material
(See Std Spec. M100-12).
(Place full length of drain)



STANDARD APPROACH SLAB - TYPE B

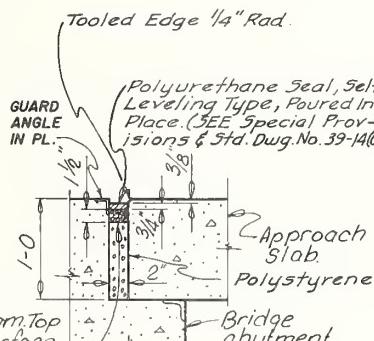
(For use with asphalt pavement only)

Scale ~ $\frac{1}{2}'' = 1'-0''$



TYPE 1 JOINT (For rigid abut)

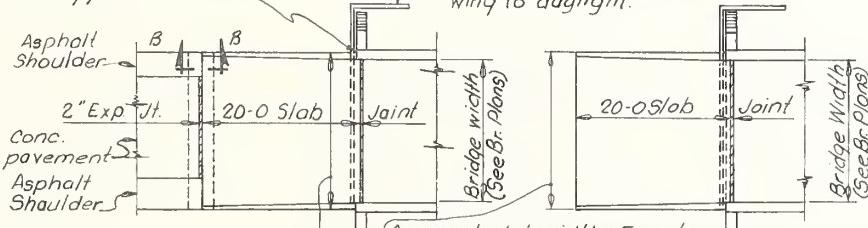
Scale ~ $1'' = 1'-0''$



TYPE 2 JOINT (For moveable abut.)

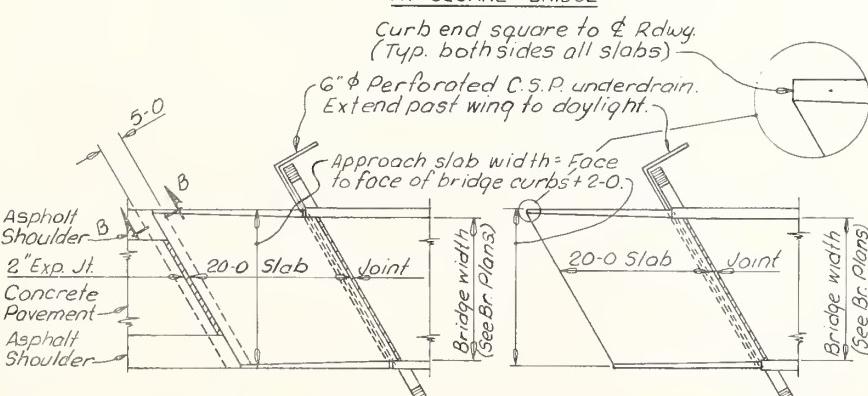
Scale ~ $1'' = 1'-0''$

Joint At Curb End To Be The
Same As That Between Abut.
And Approach Slab.



AT SQUARE BRIDGE

Curb end square to Rdwy.
(Typ. both sides all slabs)



AT SKEWED BRIDGES

PLAN VIEW OF APPROACH SLABS

No Scale

Note ~ Slab & curb shall be curved or tapered
when necessary to match roadway.

NOTES

APPROACH SLAB Approach slab shall be constructed in accordance with Section 41 of the Standard Specification. The slab shall be finished as specified for bridge decks in Article 4104(K) 2&3. Concrete shall be either Class "AD" or Class "AP" at contractors option.

REINFORCING STEEL Reinforcing steel shall be in accordance with Section 47 of the Standard Specifications except method of measurement and payment shall be as set forth below.

FOUNDATION The foundation for the approach slab and sleeper slab shall consist of the subgrade and base constructed and compacted in accordance with Standard Plans and Specifications. Excavation for joint support slab shall be held to a minimum and all area excavated but not filled with concrete shall be backfilled with the same material that was taken from the excavation. All backfill shall be layer placed and compacted with mechanical tampers. The cost of all excavation necessary for the placement of approach slab and joint support slab shall be included in the unit price bid for "Concrete Approach Slab" as set forth below.

MEASUREMENT & PAYMENT Approach slabs shall be measured by area in square yards. The width and length for measurement shall be from out to out of completed slab. No additional area will be allowed for the joint support slab. The unit price bid per square yard for "Concrete Approach Slab" shall be full compensation for furnishing all materials, equipment, tools and labor necessary to complete the work, including the joint support slab and linseed treatment.

SEALS For type and method of application of polyurethane seals see Special Provisions.

SEALANT Polyurethane sealants shall meet Federal Specification SS-S-00195a-(1)(C) or SSS-S-00200 C Sealing Compound: Two-component Elastomeric Polymer Type, Cald-Applied, Concrete Paving Joints and shall be one of the following or approved equal:

1. PRC 3105

Products Research and Chemical Corp.
Burbank, California

3. Sikaflex T-68

Sika Chemical Corp.
Lynhurst, New Jersey

2. U-Seal 3201

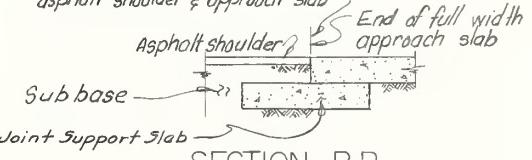
Edoco Technical Products, Inc.
Long Beach, California

4. Meta-Seal 220

American Metaseal Co.
Detroit, Michigan

PROTECTIVE COATING Approach Slab And Curb
Shall Be Given A Protective Coating Of Boiled
Linseed Oil. See Standard Specifications.

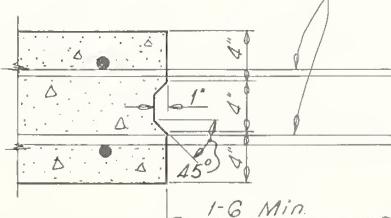
Exp. Jt. not required between
asphalt shoulder & approach slab



SECTION B-B

Note Traffic shall not be permitted on new approach slab for at least 14 days after concrete has been placed. Traffic shall not be allowed to drive within 5 feet of the construction joint and shall be restricted to a speed of not more than 5 m.p.h. for at least 48 hours after the concrete in adjacent slab has been placed.

Transverse slab steel



LONGITUDINAL CONSTRUCTION

JOINT DETAIL

Scale ~ $\frac{1}{2}'' = 1'-0''$

(Use only when shown on the plans or
approved by the engineer.)

REVISED
EFFECTIVE 4-15-71

STANDARD DWG. NO. 39-14 (C)

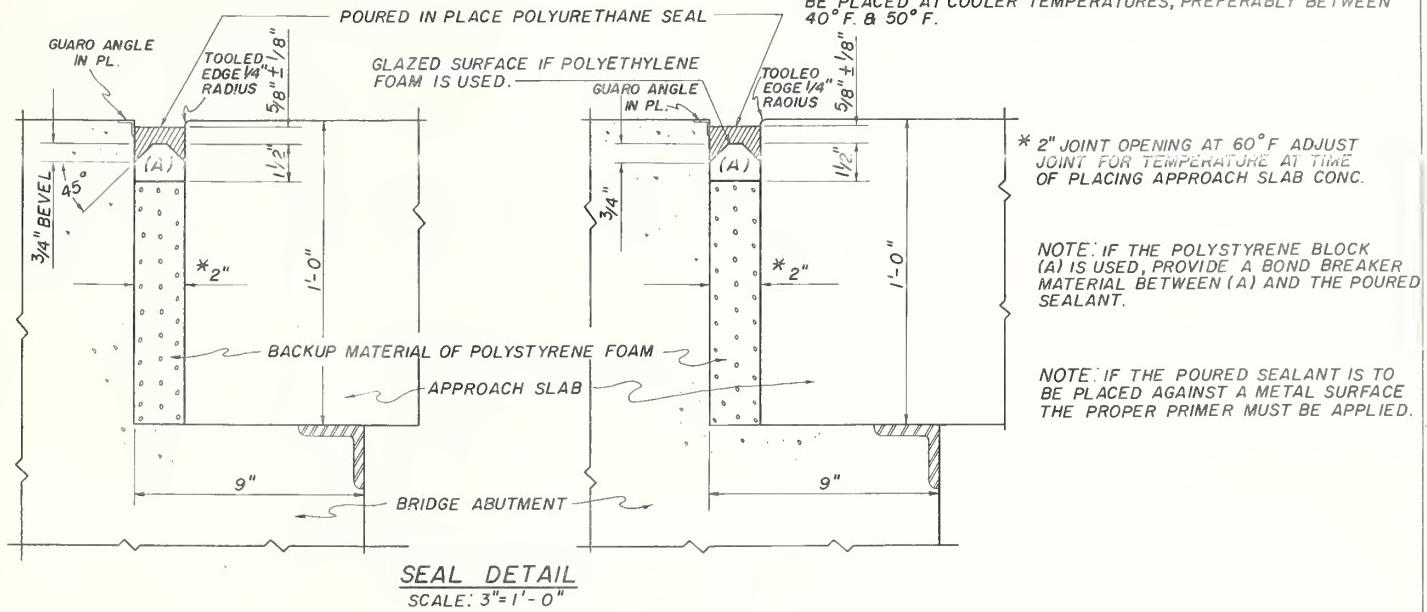
STATE HIGHWAY COMMISSION
HELENA, MONTANA

STANDARD CONCRETE APPROACH
SLAB TO STRUCTURES

APPROVED:
Levi S. Johnson 3/10/71
STATE HIGHWAY ENGINEER

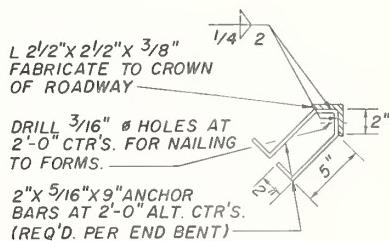
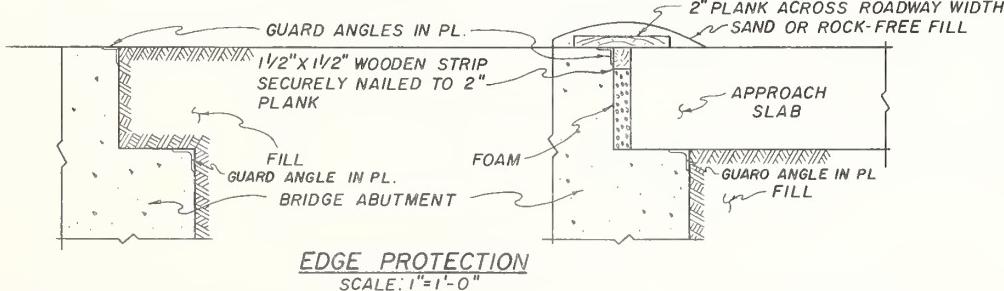
NOTE: BLOCKS (A) MAY BE CUT FROM POLYSTYRENE
OR BE PREFORMED POLYETHYLENE FOAM TO
EITHER OF THE SHAPES SHOWN.

NOTE: THE AMBIENT TEMPERATURE DURING THE PLACING OF THE SEAL
SHALL NOT BE GREATER THAN 70°F. AND IF PRACTICABLE IT SHALL
BE PLACED AT COOLER TEMPERATURES, PREFERABLY BETWEEN
40°F. & 50°F.



NOTE: IF THE CONTRACTOR INTENDS TO USE CONSTRUCTION EQUIPMENT ON THE BRIDGE DECK PRIOR TO THE PLACEMENT OF THE APPROACH SLAB, OR PRIOR TO THE PLACEMENT OF THE JOINT SEAL, HE SHALL PREVENT DAMAGE TO THE EDGES OF THE CONCRETE BRIDGE DECK AND APPROACH SLAB BY THESE METHODS OR OTHER METHODS APPROVED BY THE ENGINEER.

GUARD ANGLE MAY BE FURNISHED IN TWO PIECES WITH END ANCHOR BARS 6" MAX. FROM EACH END.



MIXING GREAT CARE SHOULD BE USED IN MIXING

THE SEALANT IS NORMALLY A TWO COMPONENT SYSTEM WITH SPECIFIC MIXING INSTRUCTIONS SUPPLIED BY THE MANUFACTURER. GENERALLY, THE MIX RPM MUST BE REDUCED TO LOW SPEED TO AVOID EXCESSIVE AIR ENTRAPMENT. APPLICATION MAY BE MADE BY GUN OR POURING.

SOME TYPES OF SEALANT ARE PROVIDED IN TWO GRADES; (1) SELF LEVELING AND (2) NON SAG. THERE IS GENERALLY NO DIFFERENCE IN COST AND DEPENDING UPON THE RECOMMENDATIONS OF THE MANUFACTURER ONE GRADE IS USED IN THE HORIZONTAL OR SLAB SECTION OF THE JOINT AND ANOTHER GRADE MAY BE REQUIRED FOR THE VERTICAL OR CURB SECTION OF THE JOINT.

JOINT PREPARATION THE VERTICAL FACES OF THE HORIZONTAL SHALL BE CLEANED BY SANDBLASTING UNTIL FREE OF ALL BONDED JOINT FORM MATERIAL, OUST, DIRT, CURING COMPOUND, LAITANCE AND OTHER FOREIGN MATTER. FOLLOWING SANDBLASTING, REMOVE ALL LOOSE MATERIAL FROM THE JOINT WITH OIL FREE COMPRESSED AIR AT APPROXIMATELY 120 CFM AND A NOZZLE PRESSURE OF APPROXIMATELY 90 PSI. IF THE SEAL IS TO BE PLACED AGAINST METAL, SUCH AS A GUARD ANGLE, THE METAL SURFACE SHALL BE DRY, CLEAN, FREE OF CORROSION, MILL SCALE, OIL, TAR, PAINT OR OTHER CONTAMINATION. THE BOND SURFACE SHOULD BE SANDBLASTED TO WHITE METAL. THE JOINT SHOULD AGAIN BE BLOWN OUT BY MEANS OF DRY, OIL FREE COMPRESSED AIR AFTER THE COMPLETION OF ALL CLEANING OPERATIONS, PLACEMENT OF POLYSTYRENE FILLERS AND BLOCK A AND JUST PRIOR TO PRIMING (WHEN REQUIRED).

PRIMING MOST SEALANTS REQUIRE A PRIMER. AFTER CLEANING OPERATIONS HAVE BEEN COMPLETED AND THE BACKUP MATERIAL IS IN PLACE THE PRIMER IS APPLIED. PRIMERS ARE SUPPLIED FOR VARIOUS CONDITIONS. THEY ARE AVAILABLE FOR APPLICATION TO CONCRETE OR METAL SURFACES AND FOR TEMPERATURES OF 15° TO 80° AND FOR TEMPERATURES ABOVE 80°. IT IS OF MOST IMPORTANCE THAT THE PROPER PRIMER IS USED AND THAT ITS APPLICATION IS TO THE VERTICAL SURFACES ONLY. PRIMING OF THE BACKUP MATERIAL OR THE TOP SURFACES OF BLOCK A SHOULD BE AVOIDED AS MUCH AS POSSIBLE.

A CAREFUL INSPECTION SHOULD BE MADE AFTER PRIMER APPLICATION TO INSURE COMPLETE COVERAGE OF THE SIDE FACES. IF "MISSING SPOTS" OCCUR, RE-PRIME.

THE SEALANT SHOULD NOT BE PLACED UNTIL THE PRIMER IS COMPLETELY DRY. IF CONDITIONS PREVENT PLACEMENT OF SEALANT FOR MORE THAN SIX HOURS AFTER PRIMING THE SURFACE SHOULD BE REPRIMED.

A BOND BREAKER MATERIAL MAY BE REQUIRED BETWEEN BLOCK A AND THE SEALANT AS NOTED ON THE ATTACHED SKETCH.

SEALING THE MOST IMPORTANT REQUIREMENT OF PLACING THE SEALANT IS TO INSURE THAT THE MAXIMUM THICKNESS ABOVE BLOCK A DOES NOT EXCEED 3/4" AT THE CENTER OF THE JOINT. BE ESPECIALLY CERTAIN TO MAINTAIN THE 5/8" MEAN DIMENSION AS SHOWN ON THE ATTACHED DETAIL.

SINCE THE VARIOUS ACCEPTABLE PRODUCTS USED AS SEAL MATERIAL VARY SOMEWHAT WITH RESPECT TO APPLICATION TEMPERATURES, CURE REQUIREMENTS, METHOD OF APPLICATION, ETC., ONLY THE VERY IMPORTANT KNOWN PROBLEM AREAS ARE MENTIONED HERE.

C

C

C

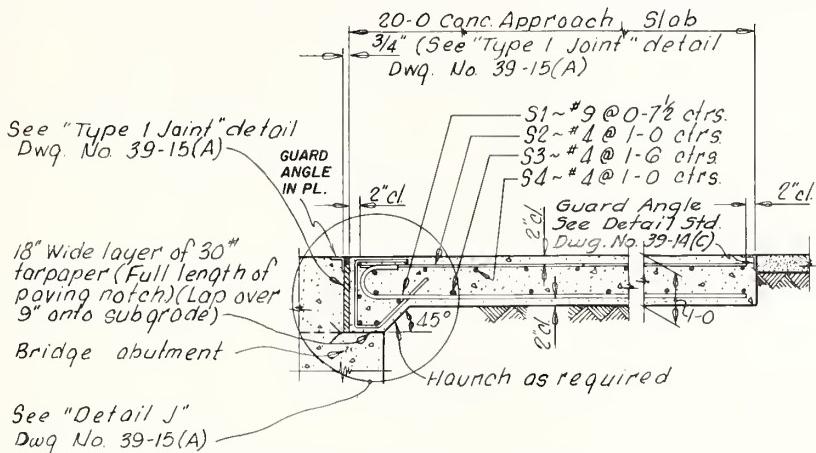
REVISED 3-6-70 3-9-71
EFFECTIVE 4-1-70 4-15-71

STANDARD DRAWING NO. 39-15 (B)

STATE HIGHWAY COMMISSION
HELENA, MONTANA

STANDARD CONCRETE APPROACH SLABS TO STRUCTURES WITH U-TYPE ABUTMENTS

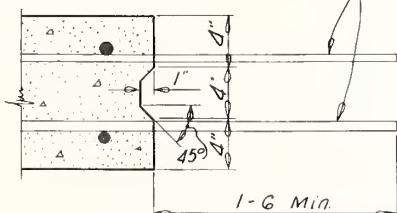
Approved by
[Signature] 4/1/70
STATE HIGHWAY ENGINEER



STANDARD APPROACH SLAB - TYPE D (For use with asphalt pavement only)

Scale ~ $\frac{1}{2}$ " = 1'-0"

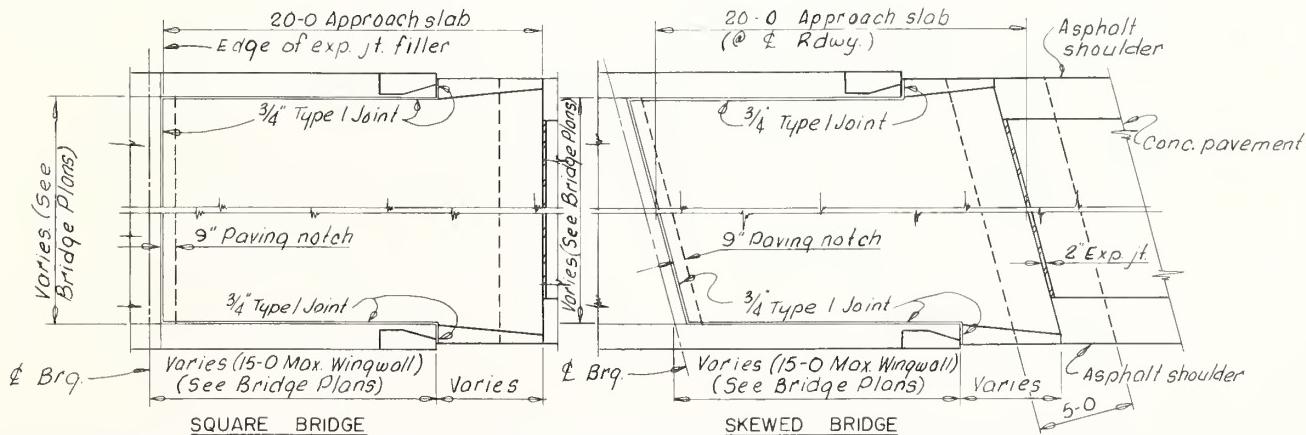
Transverse slab steel



LONGITUDINAL CONSTRUCTION JOINT DETAIL

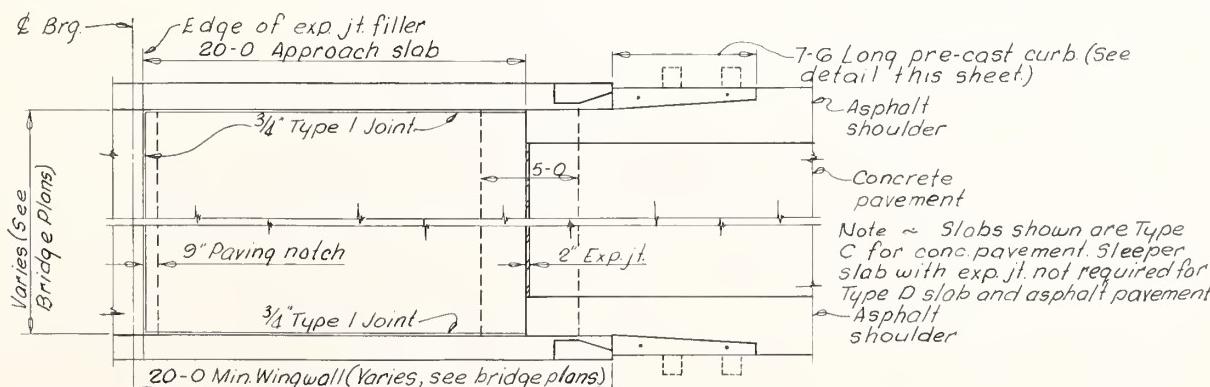
Scale ~ $\frac{1}{2}$ " = 1'-0"

(Use only when shown on the plans or
approved by the engineer.)



APPROACH SLAB WITH CAST IN PLACE CURB (15'-0 MAXIMUM WINGWALLS)

Scale ~ $\frac{3}{16}$ " = 1'-0"



APPROACH SLAB WITH PRECAST CURBS (20'-0 MINIMUM WINGWALLS)

Scale ~ $\frac{3}{16}$ " = 1'-0"

APPROACH SLAB: Approach slab shall be constructed in accordance with Section 41 of the Standard Specifications. The slab shall be finished as specified for bridge decks in Article 4104(K)2 & 3. of the Standard Specifications. Concrete shall be either Class AD or Class AP at contractor's option.

REINFORCING STEEL: Reinforcing steel shall be in accordance with Section 47 of the Standard Specifications except method of measurement and payment shall be as set forth below.

FOUNDATION: The foundation for the approach slab and sleeper slab shall consist of the subgrade and base constructed and compacted in accordance with the Standard Specifications. Excavation for joint support slab shall be held to a minimum and all area excavated but not filled with concrete shall be backfilled with the same material that was taken from the excavation. All backfill shall be loam placed and compacted with mechanical tampers. The cost of all excavation necessary for the placement of approach slab and joint support slab shall be included in the unit price bid for "Concrete Approach Slab" as set forth below.

MEASUREMENT & PAYMENT: Approach slabs shall be measured by area in square yards. The width and length for measurement shall be from out to out of completed slab. No additional area will be allowed for the joint support slab. The unit price bid per square yard for "Concrete Approach Slab" shall be full compensation for furnishing all materials, equipment, tools and labor necessary to complete the work, including the joint support slab and linseed treatment.

PROTECTIVE COATING: Approach slab and curb shall be given a protective coating of bailed linseed oil. See Standard Specifications.

Note: Traffic shall not be permitted on new approach slab for at least 14 days after concrete has been placed. Traffic shall not be allowed to drive within 5 feet of the construction joint and shall be restricted to a speed of not more than 5 m.p.h. for at least 48 hours after the concrete in adjacent slab has been placed.



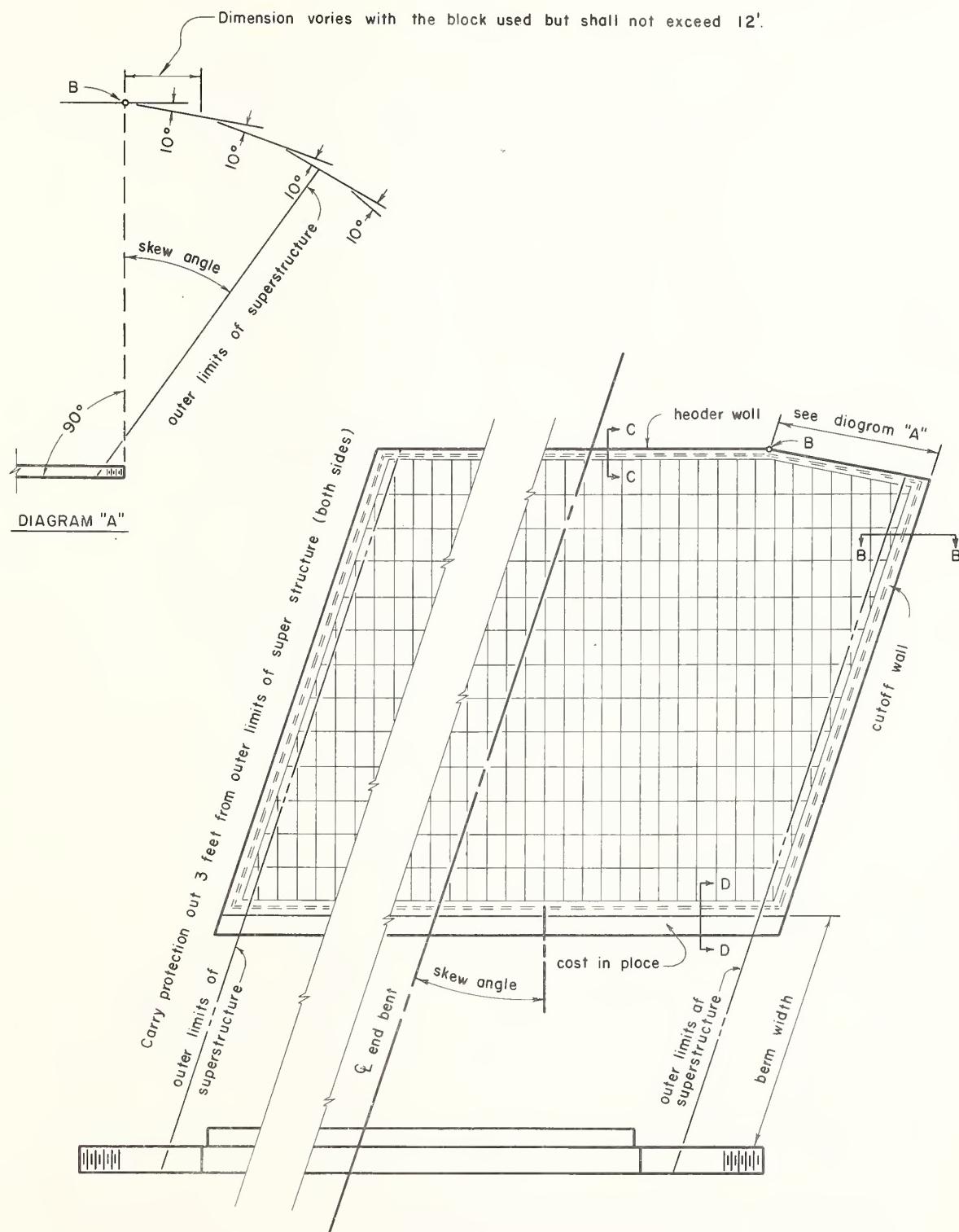
REVISED
EFFECTIVE 1-1-71

STANDARD DRAWING NO. 50-20-A

STATE HIGHWAY COMMISSION
HELENA, MONTANA

CONCRETE SLOPE PROTECTION
(SEE 50-20 B & C)

APPROVED
Louis M. St. Germain
STATE HIGHWAY ENGINEER



SKEWED BRIDGE

NOTE:

Odd sections may be precast or cast in place at the contractor's option.

Drawings not to scale.

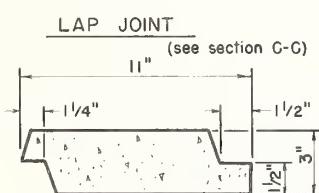
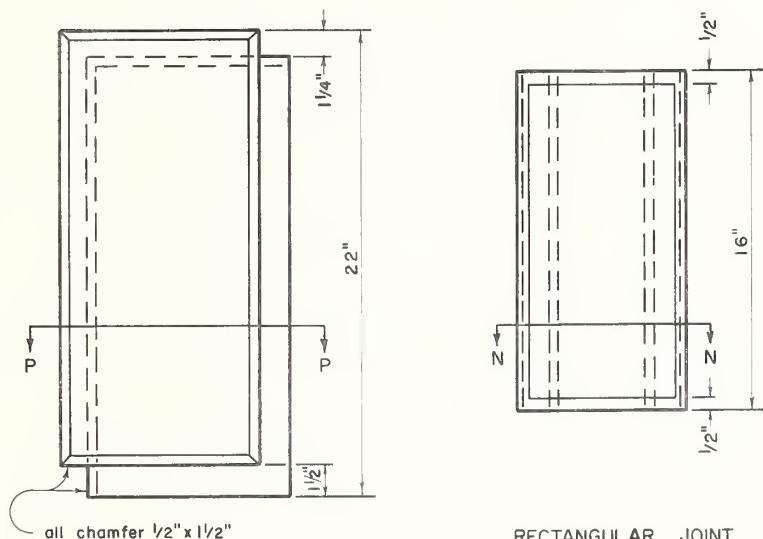
REVISED
EFFECTIVE 1-1-71

STATE HIGHWAY COMMISSION
HELENA, MONTANA

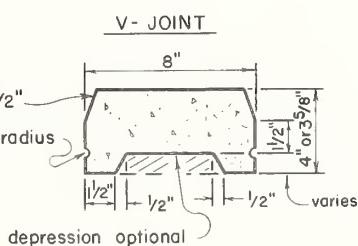
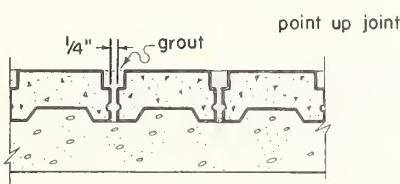
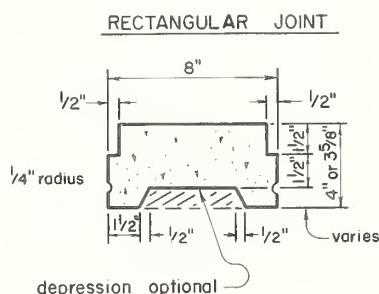
CONCRETE SLOPE PROTECTION
(SEE 50-20 A & C)

STANDARD DRAWING NO. 50-20-B

APPROVED
Louis P. Hallinan
STATE HIGHWAY ENGINEER



SECTION P-P



SECTION N-N

Typical placement of the rectangular & V-joint

NOTES

Size of Precast Blocks: The contractor may choose the type and size of blocks may be 11"x 22", 22"x 44", or 44"x 66". Rectangular or V-joint blocks may be 8"x 16", 16"x 32", 32"x 48".

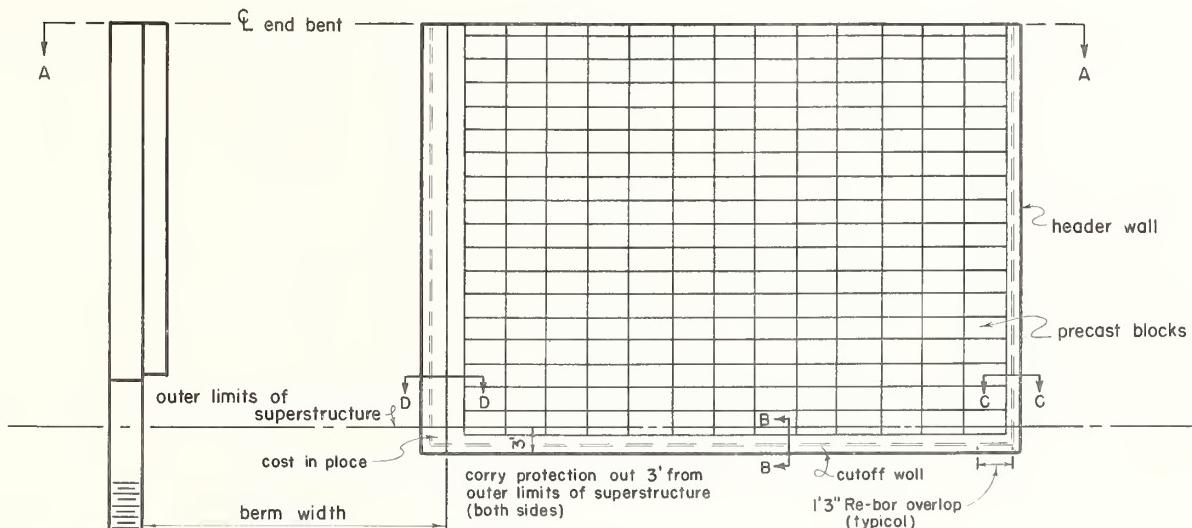
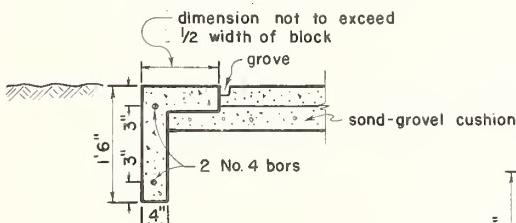
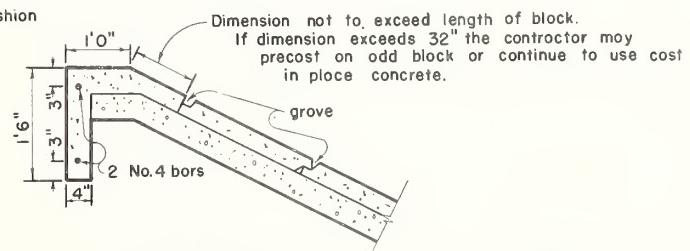
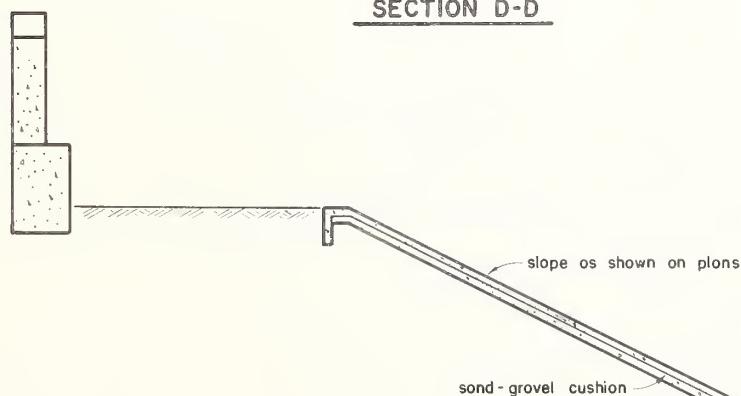
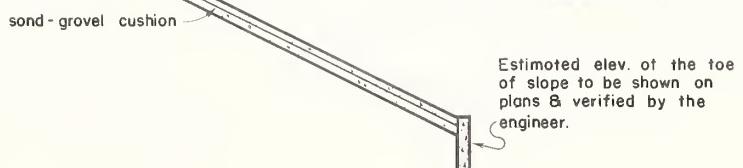
Placement of Slope Protection: The concrete slope protection shall be placed after the structure has been finished and backfill around the structure is in place.

Embankment Preparation: The embankment slope shall be cleared of all brush, debris, and rubble. When a cushion is used the embankment slope shall be leveled to a reasonably uniform slope. Where no cushion is used, level to the slope indicated on the bridge plans. All loose material shall be compacted to the satisfaction of the engineer. A minimum of four inch sand-gravel cushion and leveling course shall be placed on the prepared embankment slope. Adjacent slope area shall be left in a smooth, uniform condition.

Interrupted Block Pattern: The area around bents or where the regular block pattern is interrupted shall be constructed with cast-in-place concrete and shall be marked into sections with an approved groover to match the pattern of the surrounding blocks. An approved one-half inch expansion joint filler material shall be used where the blocks or cast-in-place concrete abuts against any part of the structure.

REVISED
EFFECTIVE 1-1-71

STANDARD DRAWING NO. 50-20-C

STATE HIGHWAY COMMISSION
HELENA, MONTANACONCRETE SLOPE PROTECTION
(SEE 50-20 A & B)APPROVED
Lewis G. Elliott
STATE HIGHWAY ENGINEERSTRAIGHT BRIDGESECTION B-BSECTION D-DSECTION C-CSECTION A-A

NOTES

Precast Blocks Rectangular blocks shall be placed with the longest dimension running up the slope blocks at any site shall be the same size and type.

All blocks shall be sound and free from cracks or other defects that would interfere with the proper placing of unit, or impair the strength or permanence of the construction. Any blocks broken or damaged so that the function of the block is impaired before the final inspection of finished project shall be replaced by the contractor at his expense.

General Concrete headers and cutoff walls shall be included in the slope paving area and paid for in square yards of slope paving. Concrete used shall be class "DD" (the concrete slope protection will cover the area shown on the plans.) concrete-class "DD" or equal.

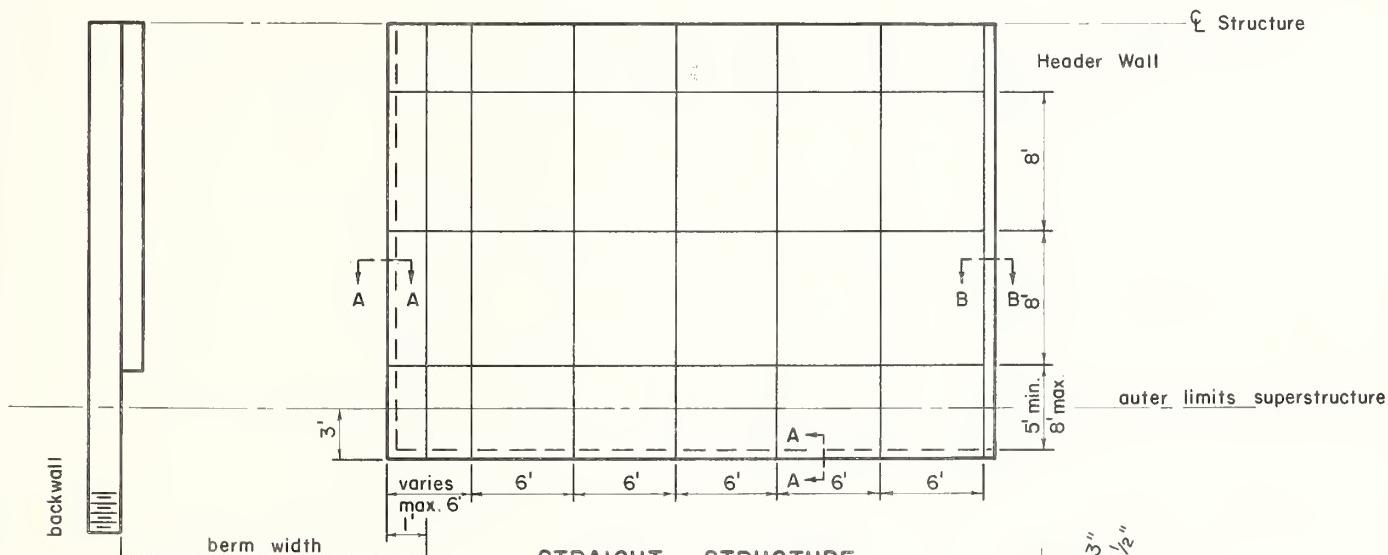
REVISED **EFFECTIVE** 1-1-31

STANDARD DRAWING NO. 50-21-A

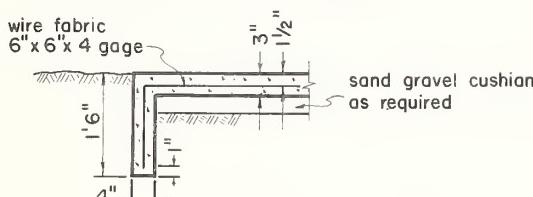
STATE HIGHWAY COMMISSION
HELENA, MONTANA

**CONCRETE SLOPE PROTECTION
ALTERNATE II (SEE 50-21 B)**

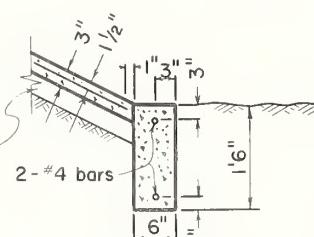
APPROVED
STATE HIGHWAY ENGINEER



STRAIGHT STRUCTURE



SECTION B-B



SECTION A-A

backwall

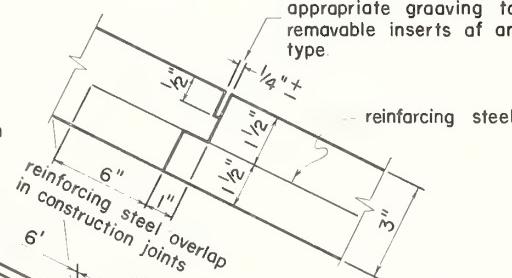
slope toward slope protection 6" in 12"

varies max. 6'

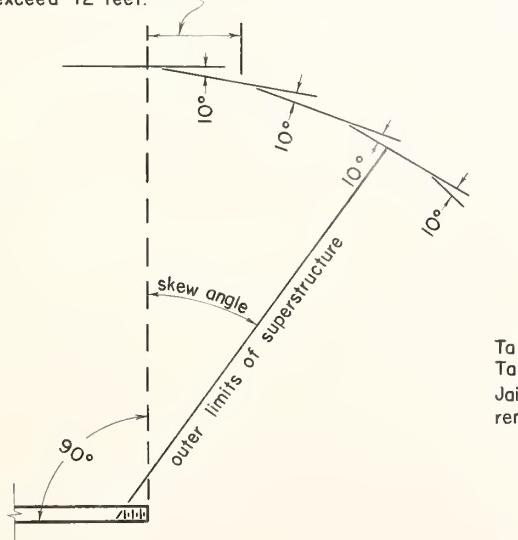
6'

6' slope as shown on plans

Joints may be sawed, made with the appropriate gluing tools, or removable inserts of an approved type.



dimension varies but shall not exceed 12 feet.



VERTICAL & HORIZONTAL DIMENSION JOINT

To be placed at 6' vertical spacing or as noted.
To be placed at 8' horizontal spacing or as noted.
Joints may be sawed, made with grooving tools, or
removable inserts of an approved type.

VERTICAL & HORIZONTAL CONSTRUCTION JOINT

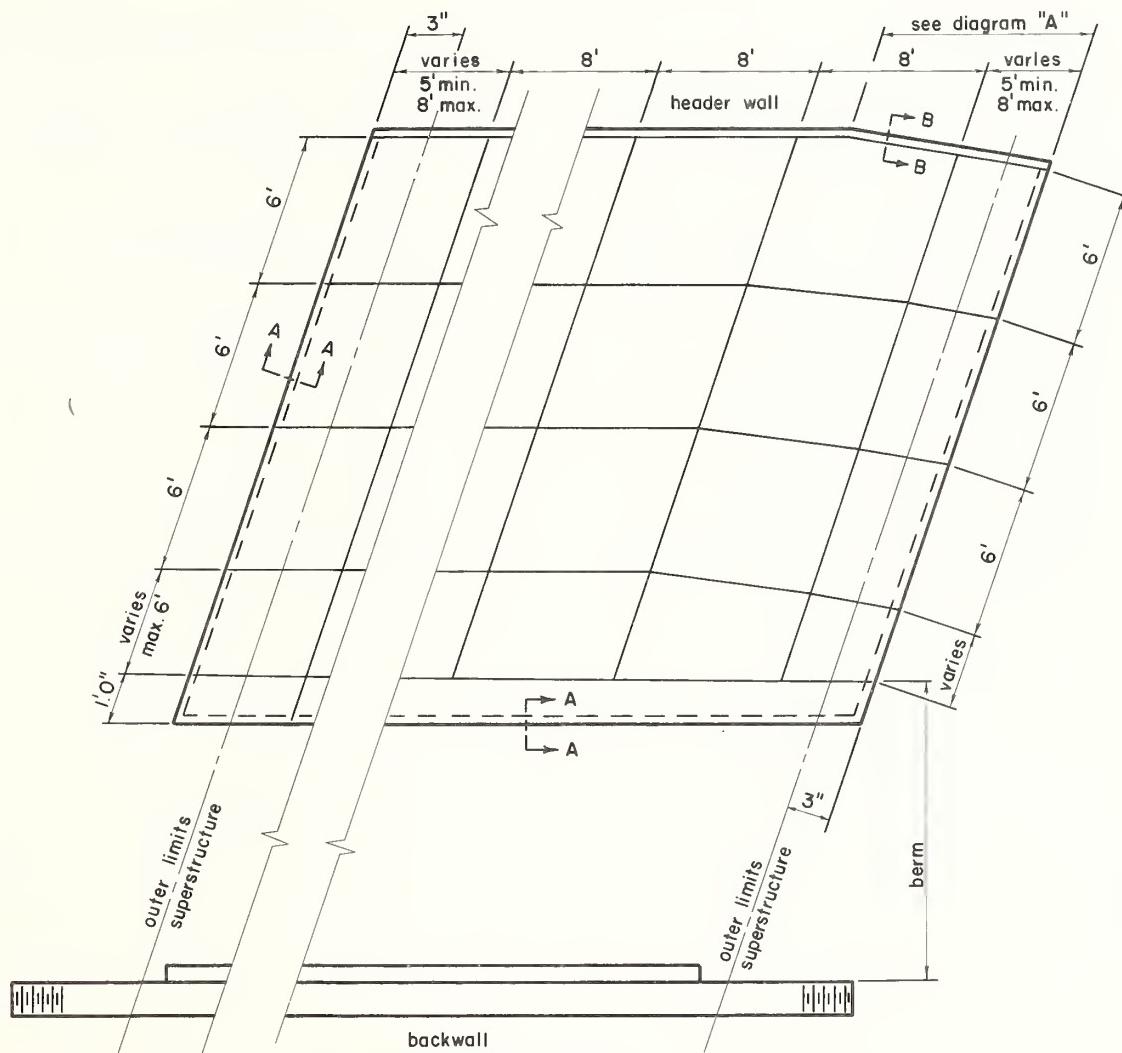
Use as need in placing slab. When required will be used in lieu of a dimension joint at the same spacing as a dimension joint.

REVISED
EFFECTIVE 1-1-71
STATE HIGHWAY COMMISSION
HELENA, MONTANA

CONCRETE SLOPE PROTECTION
ALTERNATE II (SEE 50-21 A)

STANDARD DRAWING NO. 50-21-B

APPROVED
James W. Miller
STATE HIGHWAY ENGINEER



SKEWED STRUCTURE

NOTE:

For additional notes see Standard Drawing No. 50-02

CAST IN PLACE CONCRETE

Locate joints as indicated on the plans. If construction is stopped for over two hours a construction joint shall be made. Payment shall be the same as for concrete blocks. Class "DD" concrete shall be used for all cast-in-place concrete.

An approved one half inch expansion joint filler shall be used wherever the cast in place concrete abuts against any part of the bridge structure concrete - class "DD" or equal.

REINFORCING STEEL

(may use either alternate listed below)

1. 3 bars at 0'10" centers (horiz. & vert. spacing)
min. cover of 1 inch.
2. Welded wire fabric 6"x 6"x 4 gage.

Six inch lap required at construction joints for reinforcing steel.

Drawn 3-1-66

REVISED 7-9-68
EFFECTIVE 11-1-68

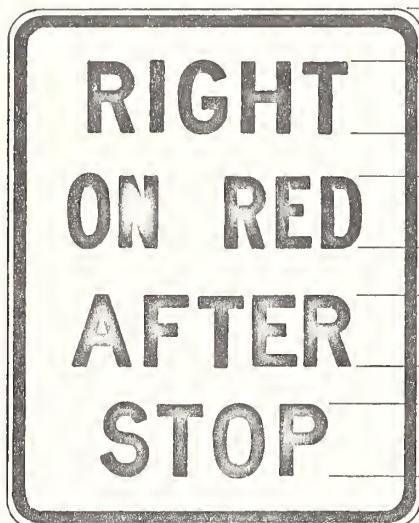
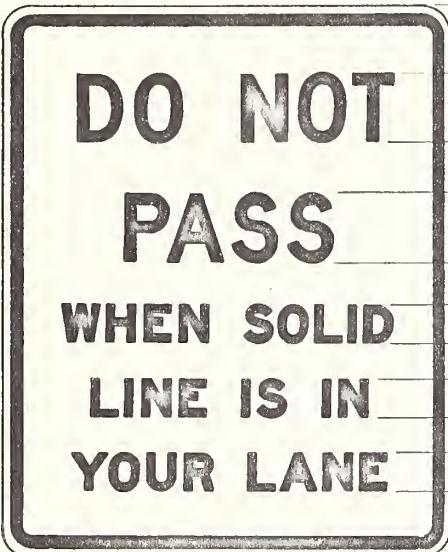
STANDARD DRAWING NO.

88-08

State Highway Commission
Helena, Montana

R4-12, R4-13, RIO-8, RIO-9

Approved

Lewiston Chilling 9-22-68
State Highway Engineer

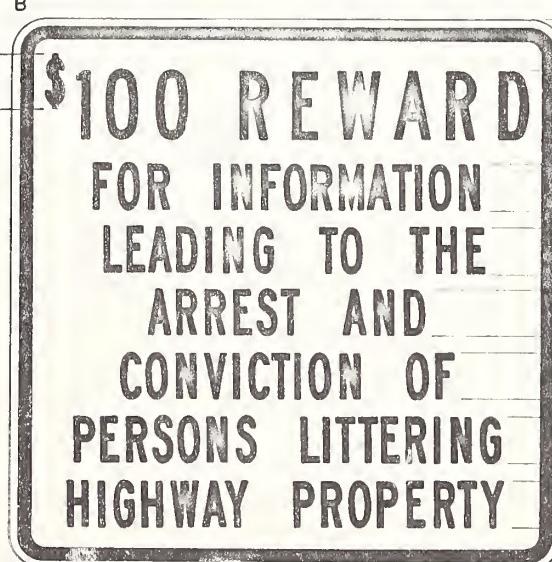
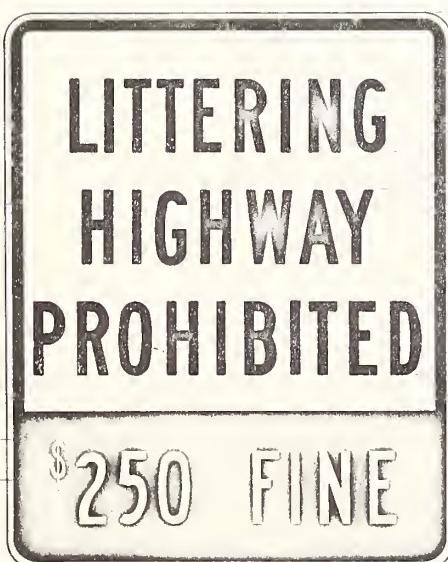
R4-12

24 X 30

MARGIN = $\frac{3}{8}$ "BORDER = $\frac{5}{8}$ "CORNER RADIUS = $1\frac{1}{2}$ "

R4-13

24 X 30

MARGIN = $\frac{3}{8}$ "BORDER = $\frac{5}{8}$ "CORNER RADIUS = $1\frac{1}{2}$ "

RIO-8

24 X 30

MARGIN = $\frac{3}{8}$ "BORDER = $\frac{5}{8}$ "CORNER RADIUS = $1\frac{1}{2}$ "

RIO-9

24 X 24

MARGIN = $\frac{3}{8}$ "BORDER = $\frac{5}{8}$ "CORNER RADIUS = $1\frac{1}{2}$ "

Drawn 3-1-63

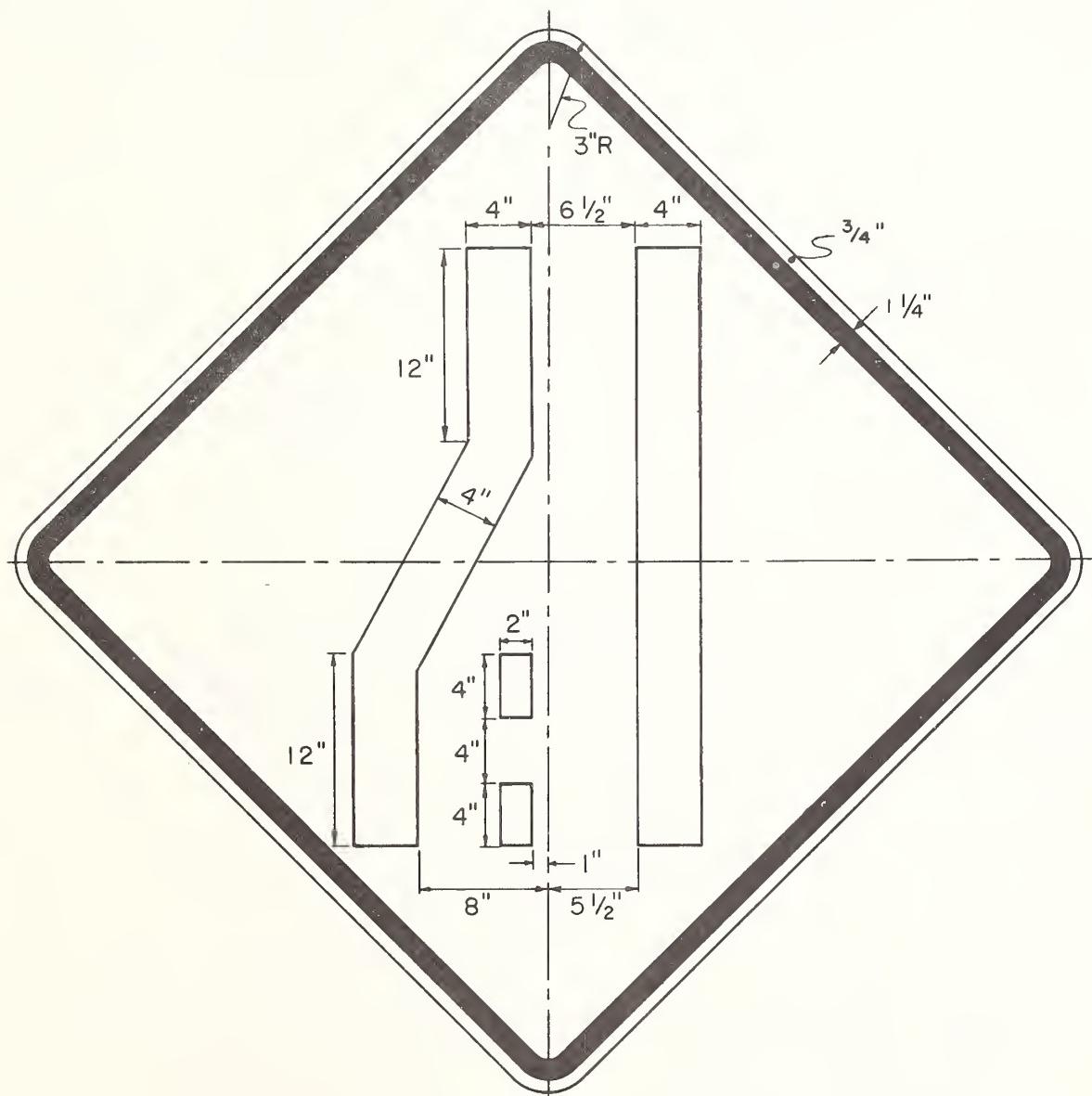
REVISED
EFFECTIVE9-1-70
3-1-63 1-1-71

STANDARD DRAWING NO. 88-16

State Highway Commission
Helena, Montana

STANDARD W4-2 WARNING SIGN

Approved

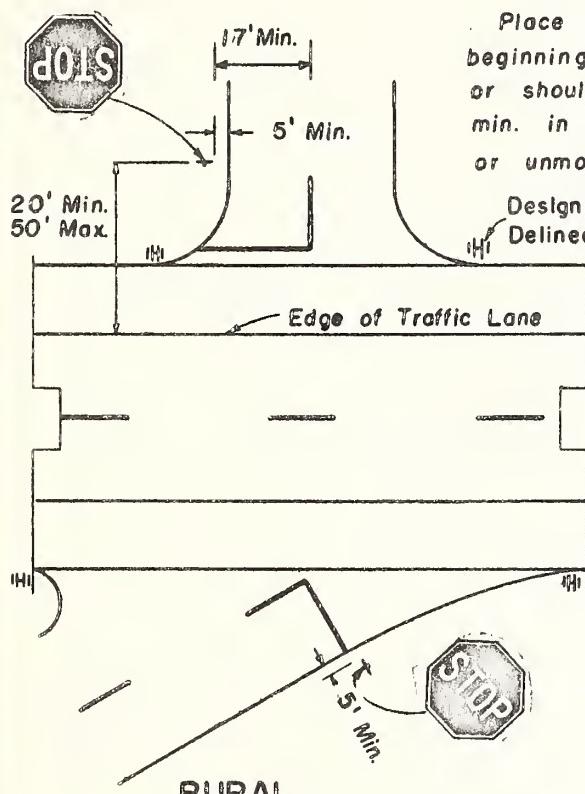
Louis P. Buttner 11-4-68
State Highway Engineer

W4-2
48" X 48"

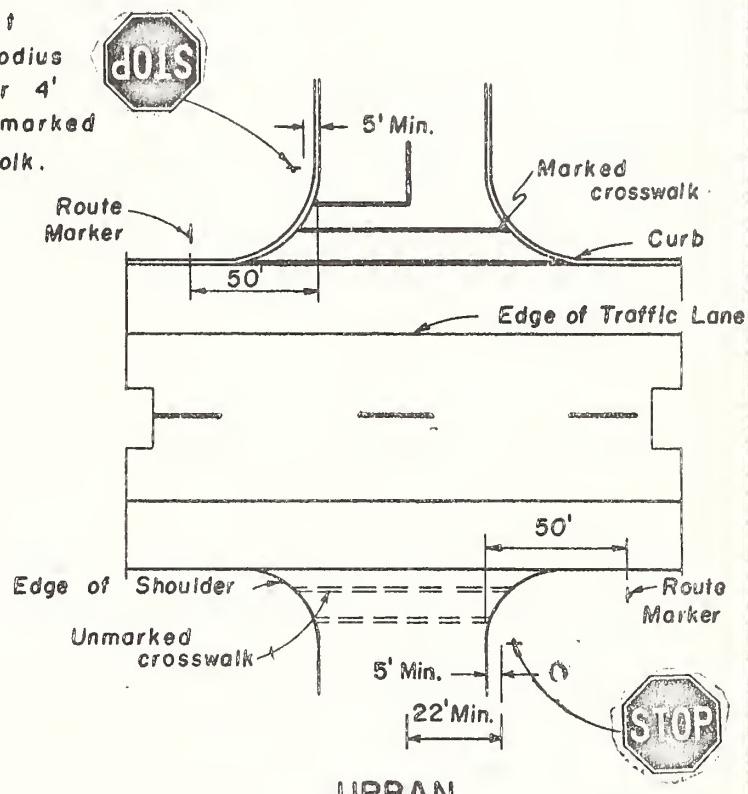
BLACK ON REFLECTORIZED YELLOW

State Highway Commission
Helena, Montana

TYPICAL APPROACH ROAD SIGNING

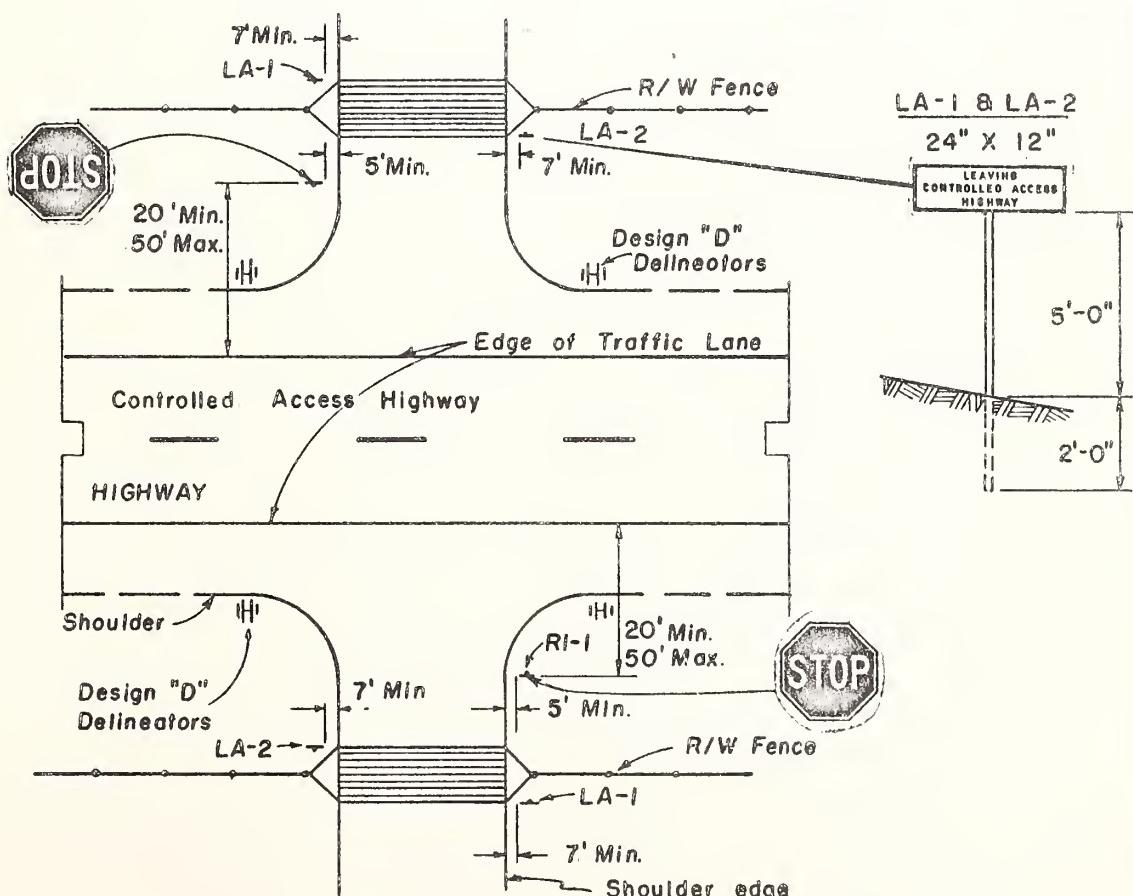
Approved
Loring D. Hulse, PE 15-62
State Highway Engineer

RURAL



URBAN

Note:
LA-1 & LA-2 Shall be mounted on galvanized steel 'U' posts, 2 Lbs./Ft.



CONTROLLED ACCESS

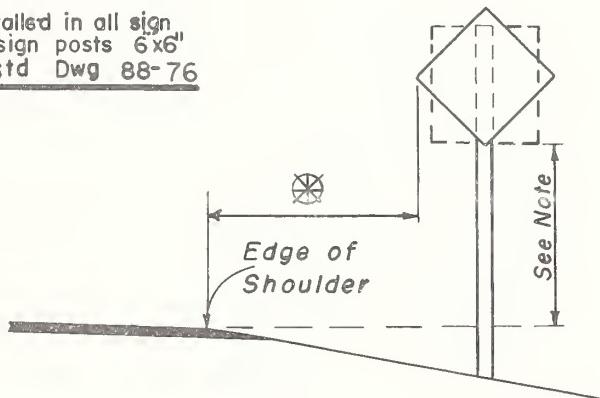
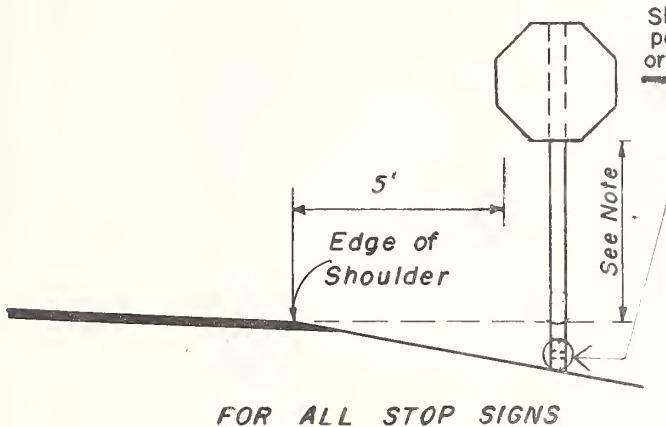
Drawn 6-1-65

Revised 11-1-68 9-1-70
Effective 1-1-69 1-1-71

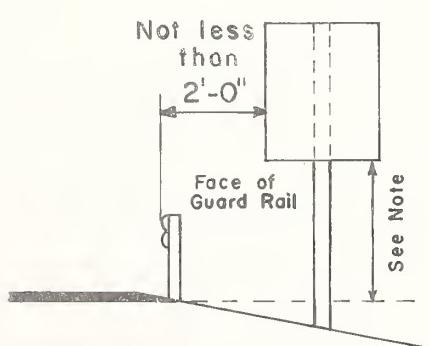
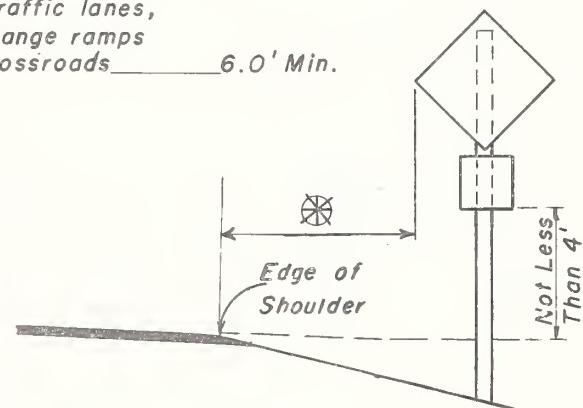
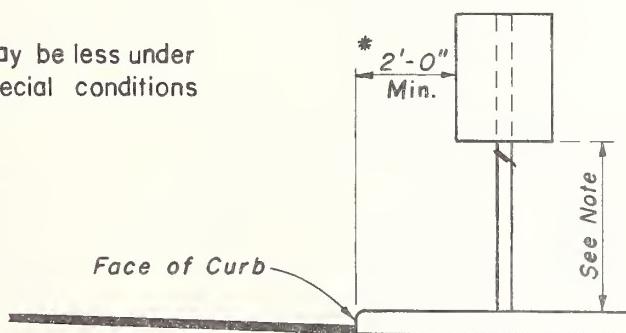
STANDARD DRAWING NO. 88-57

State Highway Commission
Helena, Montana

TYPICAL SIGN ERECTION

Approved
Lewis M. Johnson, P.E.
State Highway EngineerFOR REGULATORY & WARNING SIGNS

* May be less under special conditions



FOR GUARD RAIL SECTION

NOTE:

SIGNS LESS THAN 10 SQ. FT. SHALL BE MOUNTED 10' FROM SHOULDER EDGE.

SIGNS GREATER THAN 10 SQ. FT. SHALL BE MOUNTED 20' FROM SHOULDER EDGE.

Drawn 12-16-61

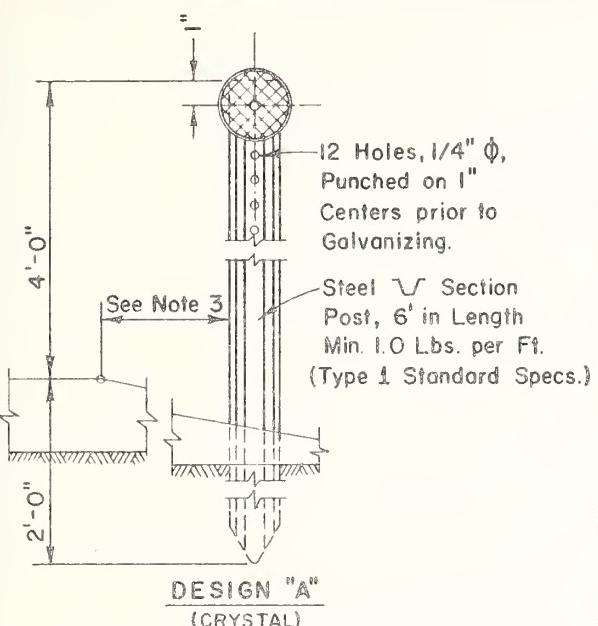
REVISED 11-1-68 6-10-69
EFFECTIVE 1-1-69 7-1-69

STANDARD DRAWING NO. 88-91

State Highway Commission
Helena, Montana

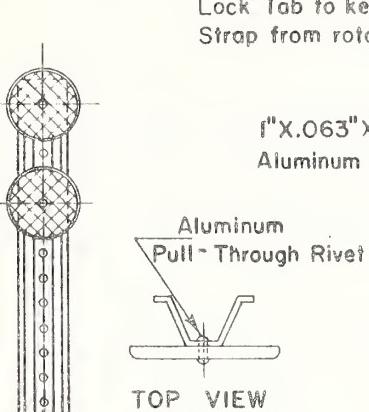
DELINEATORS TYPE I

Approved

Lund of Shultz 8-15-61
State Highway EngineerDESIGN "A"
(CRYSTAL)Typical Use:

Interstate - Continuous along roadway.

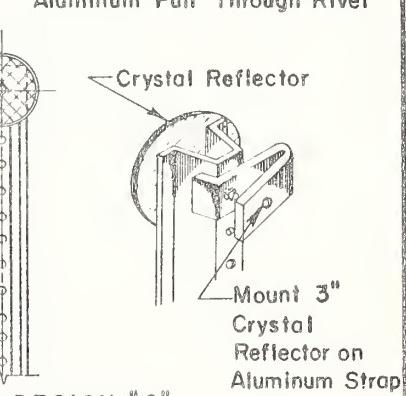
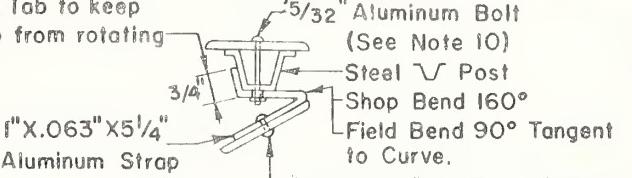
Primary & Secondary - Where warranted.

DESIGN "B"
(AMBER)Typical Use:

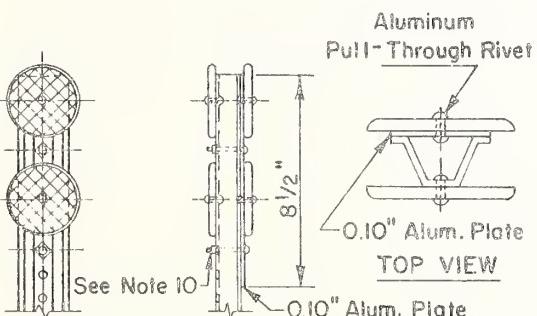
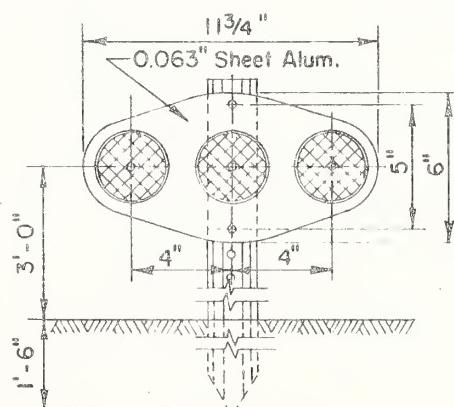
All ramps and speed change lanes.

Special Use:

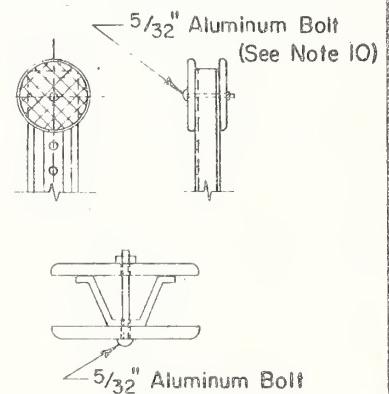
Construction zones or temporary connections, only as warranted by an engineering study.

DESIGN "C"
(CRYSTAL, BI-DIRECTIONAL)
(ADJUSTABLE)Typical Use:

On curves sharper than 7° 30' where necessary to aim delineator lens for full reflectivity.

DESIGN "D"
(AMBER, BI-DIRECTIONAL)Typical Use:Ramp terminus with crossroad.
Road approaches to major highway.DESIGN "E"
(AMBER)Typical Use:

Mounted in gore at exit ramps. At curbed nose of median or other channelization.

DESIGN "F"
(CRYSTAL, BI-DIRECTIONAL)Typical Use:

Tangent run-off in conjunction with Design "C". (See Std. Dwg. 88-92 and 7° end flatter).

NOTES:

- Post type shall be as shown in DESIGN "A" for all designs.
- Reflectors shall be center mount.
- Post with delineators shall be placed facing oncoming traffic, 2'-0" clear from edge of shoulder or the face of curb, or as shown on plans.
- Posts shall be driven, using an approved metal driving cap, prior to installation of the delineators.
- All sheet aluminum shall conform to Standard Specifications.
- For spacing of delineators, see Horizontal Spacing Chart, Standard Drawing No. 88-92.
- On tangents, unless otherwise specified in the plans, the nominal spacing of delineators shall be 264'.

Standard

- Posts shall be installed behind guard rail posts where there is guard rail installed along the highway.
- Where, under normal spacing, a delineator post falls within a crossroad, that post may be moved in either direction a distance not to exceed one quarter of the normal spacing.
- 5/32" Aluminum Bolts of suitable length. Jam threads after turning nut tight to prevent removal. Rivet delineators to plate prior to mounting.

DELINEATOR LEGEND			
→	DESIGN A	→	DESIGN D
→	DESIGN B	→	DESIGN E
↓→	DESIGN C	→	DESIGN F



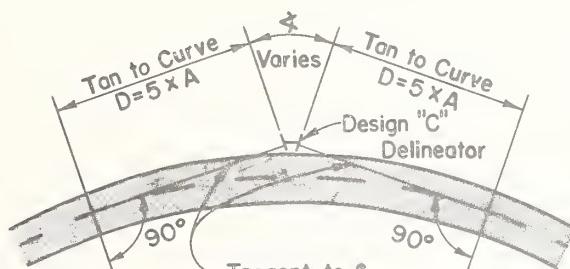
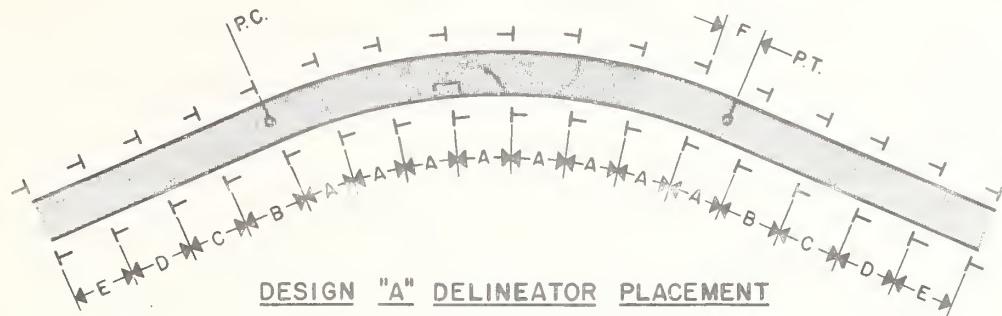
Drawn 5-1-65

REVISED 11-1-68 V.H.W. 69
EFFECTIVE 1-1-69 V-1-70 1-1-71

STANDARD DRAWING NO. 88-92

State Highway Commission
Helena, MontanaDELINEATOR SPACING FOR
HORIZONTAL HIGHWAY CURVES

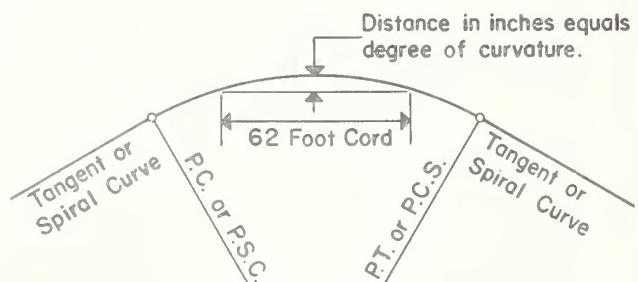
Approved

Lewis C. Elliott R.S. 67
State Highway Engineer

Place Design "C" Delineators on curves sharper than $7^{\circ} 30'$. Position delineator faces perpendicular to tangent to center line of curve as shown. Spacing shall be as called for in Table below.

DEGREE OF CURVE	SPACING "A" ON CURVE	SPACING ON BOTH APPROACHES			
		B	C	D	E
0° TO 30'	200'	264'	264'	264'	264'
30°+ TO 1°	175'	264'	264'	264'	264'
1°+ TO 2°	125'	225'	264'	264'	264'
2°+ TO 3°	95'	170'	264'	264'	264'
3°+ TO 4°	80'	145'	240'	264'	264'
4°+ TO 6°	70'	125'	210'	264'	264'
6°+ TO 8°	55'	100'	165'	264'	264'
8°+ TO 12°	45'	80'	135'	264'	264'
12°+ TO 20°	35'	65'	115'	210'	264'
20° PLUS	25'	45'	75'	150'	264'

FIELD METHOD FOR DETERMINING DEGREE OF HORIZONTAL CURVES



NOTES:

- If distance F is 20 feet or more, add one regular "A" space as called for in the above table.
- See Standard Drawing No. 88-91 for Delineator Design Details.
- Post with delineators shall be placed on the right hand side facing oncoming traffic, 2'-0" clear from edge of shoulder or the face of curb, or as shown on the plans.
- Type I Delineator button shall be a nominal 3" diameter reflector as specified by Standard Specifications.
- Delineator spacing on Tangent, shall be 264', unless otherwise noted on project plans.
- Interstate highways shall be continuously delineated.
- Interstate highways with split alignments shall be delineated on the inside shoulder at double the normal spacing.
- Posts shall be installed behind guard rail posts where there is guard rail installed along the highway.
- Where, under normal spacing, a delineator post falls within a crossroad, that post may be moved in either direction a distance not to exceed one quarter of the normal spacing.
- Primary & secondary highways may be continuously delineated in areas where ground blizzards are prevalent or in areas of hazardous alignment; otherwise, curves of 4° and sharper shall be delineated on the outside of the curve. Where vertical alignment is rolling, horizontal curves less than 4° may require delineation.

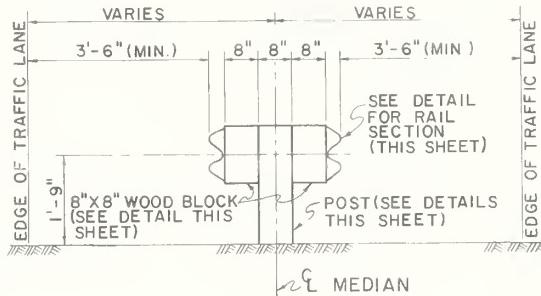
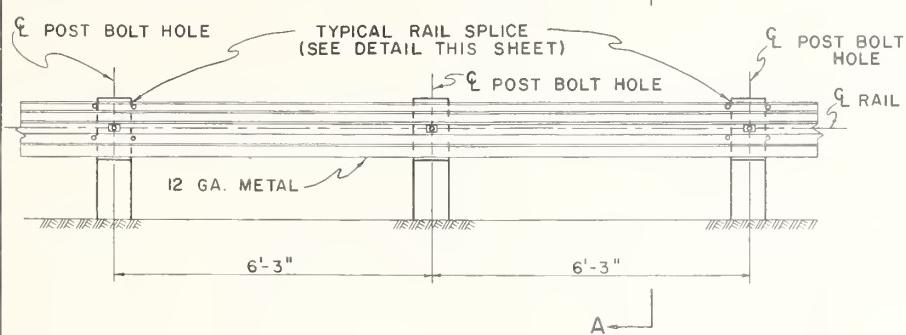
REVISED 11-1-70
EFFECTIVE 1-1-71

STANDARD DRAWING NO. 90-03

STATE HIGHWAY COMMISSION
HELENA, MONTANA

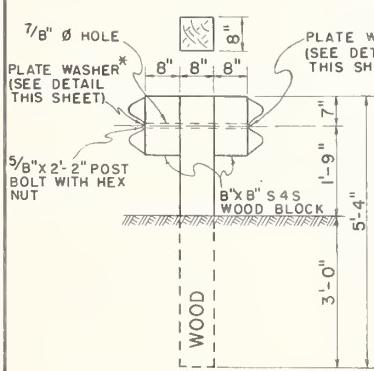
METAL MEDIAN RAIL

APPROVED
STATE HIGHWAY ENGINEER

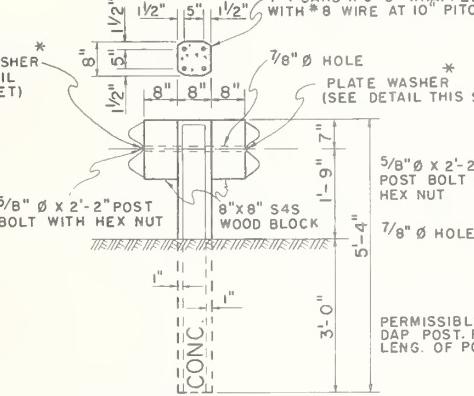


SECTION A-A

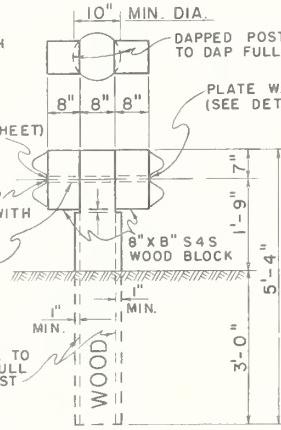
METAL BEAM MEDIAN RAIL



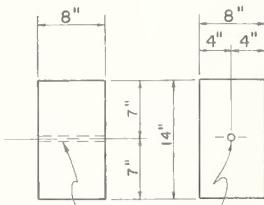
SQUARE WOOD POST



CONCRETE POST



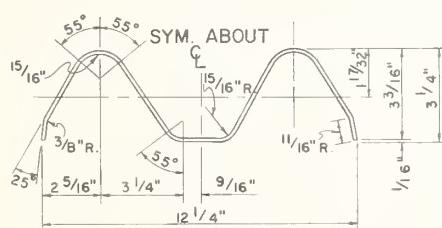
ROUND WOOD POST



WOOD BLOCK DETAIL

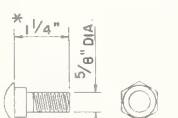
* USE REFLECTOR WASHERS IN PLACE OF PLATE WASHER AS NOTED ON STANDARD DRWG. 90-08.

DETAIL OF GUARD RAIL POSTS

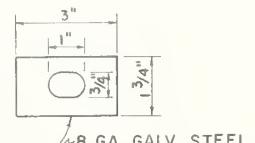


RAIL SECTION

OVAL SHOULDER
BUTTON HEAD BOLT
OR EQUAL.
POST BOLT IS SIMILAR
EXCEPT LENGTH.

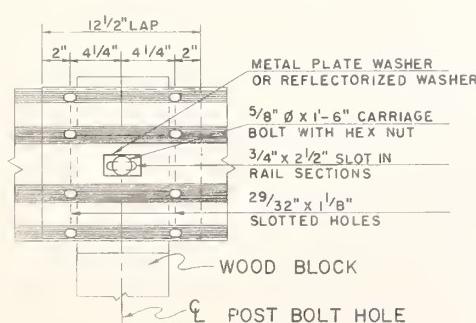


* POST BOLT LENGTH = 2'-2"



WASHER TO BE PLACED BETWEEN
HEAD AND RAIL OF POST BOLT.
USE ON POST CONNECTIONS THAT
DO NOT USE REFLECTOR WASHER.
USE ON BOTH SIDES OF MEDIAN
RAIL.

PLATE WASHER DETAIL



RAIL SPLICE DETAIL
(LAP IN DIRECTION OF TRAFFIC)

RAIL: GALVANIZED RAIL SHALL BE GALVANIZED IN ACCORDANCE WITH ASTM A 93 OR ASTM A 123. STEEL RAIL SHALL CONFORM TO AASHO M 180. ALL RAIL PLATES ARE TO BE LAPPED IN DIRECTION OF TRAFFIC.

POSTS: ROUND POSTS SHALL HAVE NO DIAMETER LESS THAN 10". ONLY ONE TYPE POST (SQUARE OR ROUND) TO BE USED WITHIN ONE PROJECT.

TERMINAL SECTIONS: SEE STD. DWG. NO. 90-05, 90-06 AND NO. 90-07 FOR APPROACH AND DEPARTURE TERMINAL SECTIONS.

BRIDGE APPROACH: SEE STD. DWG. NO. 90-04 FOR TREATMENT AT BRIDGE ENDS.

REFLECTOR WASHER: ALL SECTIONS OF GUARDRAIL SHALL HAVE REFLECTOR-WASHERS SPACED EVERY 25 FT. SEE STD. DWG. NO. 90-08 FOR DETAILS.

STATE HIGHWAY COMMISSION
HELENA, MONTANA 59601

APRIL 1, 1971

STANDARD DRAWING BOOK

We are sending the following additions and/or revisions effective April 15, 1971 to be included in your present Standard Drawing Book, the grey covered one, original issue January 1, 1961.

- ✓ 39-14(A) Standard Concrete Approach Slabs to Structures
- ✓ 39-14(B) Standard Concrete Approach Slabs to Structures
- ✓ 39-14(C) Standard Concrete Approach Slabs to Structures
- ✓ 39-15(A) Standard Concrete Approach Slabs to Structures With U-Type Abutments
- ✓ 39-15(B) Standard Concrete Approach Slabs to Structures With U-Type Abutments

NOTE: 1. Add these drawings to your book.

✓2. We are also sending new index page 2. You should destroy the old index page 2.

3/30/71

18.1d.

S. Budd Williams
for Melvin C. Rygg, P. E.
Office Engineer

STANDARD DRAWING BOOK

We are sending the following additions and/or revisions effective March 1, 1971 to be included in your present Standard Drawing Book, the grey covered one, original issue January 1, 1969.

59-00 Fill Height For S. S. P. H-20 Loading 6 x 2 Corrugations.

59-01 Fill Height for S. S. P. Arch 6 x 2 Corrugations.

NOTE:

1. Add these drawings to your book.

2. We are also sending a new index, Page 4. You should
should destroy the old index Page 4.

Melvin C. Rygg
Melvin C. Rygg, P. E. *BBW*
Office Engineer

REVISED
EFFECTIVE 1-1-71

STANDARD DRAWING NO. 59-01

STATE HIGHWAY COMMISSION
HELENA, MONTANAFILL HEIGHT FOR C.S.P. ARCH
6"X2" CORRUGATIONSAPPROVED
Lewis W. Miller
STATE HIGHWAY ENGINEER

FOR CORRUGATED STEEL PIPE ARCHES, 6-INCH BY 2-INCH CORRUGATIONS, BOLTED, FABRICATION, H-20 LOADING.

PIPE DIMENSIONS SPAN X RISE (FT.- IN.)	AREA (SQ. FT.)	CORNER RADIUS (INCHES)	MINIMUM COVER (INCHES)	MINIMUM THICKNESS REQUIRED (INCHES)	MAXIMUM FILL HEIGHTS (FEET)
					CORNER BEARING PRESSURE 2 TONS / SQ.FT.
6'-1"X4'-7"	22	18	18	0.109	15
7'-0"X5'-1"	28	18	18	0.109	15
7'-11"X5'-7"	35	18	18	0.109	12
8'-10"X6'-1"	43	18	24	0.109	11
9'-9"X6'-7"	52	18	24	0.109	10
10'-11"X7'-1"	61	18	24	0.109	9
11'-10"X7'-7"	71	18	24	0.109	8
12'-10"X8'-4"	85	18	24	0.109	8
13'-3"X9'-4"	98	31	24	0.109	13
14'-2"X9'-10"	110	31	24	0.109	12
15'-4"X10'-4"	124	31	24	0.138	11
16'-3"X10'-10"	138	31	36	0.138	11
17'-2"X11'-4"	153	31	36	0.138	11
18'-1"X11'-10"	168	31	36	0.168	9
19'-3"X12'-4"	185	31	36	0.168	9
19'-11"X12'-10"	202	31	36	0.168	8
20'-7"X13'-2"	214	31	36	0.188	8

NOTES: WHERE BEARING PRESSURES EXCEEDING 2 TONS PER SQUARE FOOT ARE REQUIRED FOR GIVEN FILL HEIGHT, THE FOUNDATION MATERIAL SHALL BE INVESTIGATED TO DETERMINE ITS BEARING CAPACITY.

IF SKEW IS REQUIRED SEE STD. DWG. NO. 56-01.

SEE STD. DWG. NO. 56-02 FOR GALVANIZED STEEL THICKNESS AND GAGE TABLE.



REVISED
EFFECTIVE 1-1-71

STANDARD DRAWING NO. 59-00

STATE HIGHWAY COMMISSION

HELENA, MONTANA

FILL HEIGHT FOR C.S.P. H-20
LOADING 6"X2" CORRUGATIONS

APPROVED

James M. Shullard
STATE HIGHWAY ENGINEER

FOR CORRUGATED STEEL PIPE, 6-INCH BY 2-INCH CORRUGATIONS, BOLTED FABRICATION,
H-20 LOADING.

PIPE DIAMETER IN INCHES	MINIMUM COVER TOP OF PIPE TO TOP OF SUBGRADE (INCHES)	MAXIMUM FILL HEIGHTS ABOVE TOP OF PIPE IN FEET						
		METAL THICKNESS IN INCHES						
		0.109	0.138	0.168	0.188	0.218	0.249	0.280
120	12	43	62	81	93	106(111)	116(132)	126(144)
72	12	36	52	68	73(78)	79(93)	85(110)	91(120)
84	12	31	44	58	61(67)	65(79)	69(94)	72(103)
96	12	27	39	51	55(58)	57(69)	60(82)	62(90)
108	24	24	34	45	50	52(62)	54(73)	56(80)
120	24	22	31	41	47	49(56)	50(66)	52(72)
132	24	20	28	37	42	47(51)	48(60)	49(66)
144	24	18	26	34	39	45	46(55)	47(60)
156	24	17	24	31	36	43	45(50)	46(56)
168	24	15	22	29	33	40	44(47)	45(52)
180	24	14	21	27	31	37	44	44(48)
192	24		19	25	29	35	41	43
204	36		18	24	27	33	39	43
216	36			23	26	31	37	40
228	36			21	25	29	35	38
240	36				23	28	33	36
252	36					27	31	34

NOTES: VALUES FOR ELONGATED PIPE ARE SHOWN IN PARENTHESIS.

USE SPECIAL DESIGN FOR STRUCTURES WITH HEIGHTS OF COVER EXCEEDING THESE TABLES.

IF SKEW IS REQUIRED SEE STD. DWG. NO. 56-01.

SEE STD. DWG. 56-02 FOR GALVANIZED STEEL THICKNESS AND GAGE TABLE.

PIPE DIAMETER (INCHES)	60	72	84	96	108	120	132	144	156	168	180	192	204	216	228	240	252
AREA (SQ. FT.)	19.6	28.3	38.5	50.3	63.6	78.5	95.0	113.1	132.7	153.9	176.7	201.1	227.0	254.5	283.5	314.2	346.4



January 1, 1971

STATE HIGHWAY COMMISSION
HELENA, MONTANA 59601

JANUARY 1, 1971

STANDARD DRAWING BOOK

We are sending the following additions and/or revisions effective January 1, 1971 to be included in your present Standard Drawing Book, the grey covered one, original issue January 1, 1969.

50-20A	Concrete Slope Protection
50-20B	Concrete Slope Protection
50-20C	Concrete Slope Protection
50-21A	Concrete Slope Protection - Alternate II
50-21B	Concrete Slope Protection - Alternate II
54-01	R. C. P. Culvert Bedding
54-06	R. C. P. & S. P. P. Culvert Bedding
56-01	Fill Height For C. S. P. H-20 Loading 2 2/3 x 1/2 Corrugations
56-02	Fill Height For C. S. P. H-20 Loading 3 x 1 Corrugations
56-10	Embankment Protector
57-00	Fill Height For C. S. P. Arch 3 x 1 Corrugations
57-01	Fill Height For C. S. P. Arch 2 2/3 x 1/2 Corrugations
59-00	Fill Height For C. S. P. H-20 Loading 6 x 2 Corrugations
59-01	Fill Height For C. S. P. Arch 6 x 2 Corrugations
81-01	Wire Fence - Interstate Type
81-02	Wire Fence - Interstate Type
81-03	Farm Fence
88-07	Standard R2-12 Sign
88-09	Signing of Median U-Turns
88-16	Standard W4-2 Warning Signs
88-18	W6-4A & W6-4B
88-19	W8-9, W9-2, W9-5 & W9-6 Warning Signs
88-28	Secondary Route Marker For Use on Guide Signs
88-36	Typical Guide Sign Layout
88-37	Informational Signs - Services
88-37A	Informational Signs - Rest Area
88-38	Standard N6-2 Stream Name Sign Primary and Secondary Routes
88-39	Weigh Station Signs
88-47	Standard Rest Area and Information Signs
88-57	Typical Sign Erection
88-58	Typical Crossroad and Ramp Layout
88-66	Standard Guide Signs
88-68	Aluminum Sheet Increment Guide Signs
88-70	Guide Sign Mounting Details
88-72	Railroad Crossing Signs
88-74	X1-1 Sign and Erection Detail
88-75	Typical Pipe Post Mounting Detail
88-76	Wood Pole Slot Detail
88-77	Typical Sign Erection
88-78	Typical Route Marker Assembly with Treated Timber Post
88-92	Delineator Spacing For Horizontal Highway Curves
90-00	5 in. Wood Guide Post
90-02	Metal Guard Rail
90-03	Metal Median Rail

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90-04	Bridge End Treatment
90-05	Guardrail Terminal Sections - Sheet 1
90-06	Guardrail Terminal Sections - Sheet 2
90-07	Pier Treatment
90-08	Reflector Washer
90-14	Guardrail for Grade Crossing Protection
100-13	Historical Marker

- NOTE:
1. Add these drawings to your book.
 2. We are also sending a complete new index, pages 1 thru 8.
You should destroy the old index Pages 1 thru 6.
 3. Note several drawings have been deleted as of January 1, 1971.

Melvin C Rygg
MELVIN C. RYGG, P. E.
OFFICE ENGINEER

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REVISED	8-1-63	10-25-68
EFFECTIVE	8-1-63	1-1-69

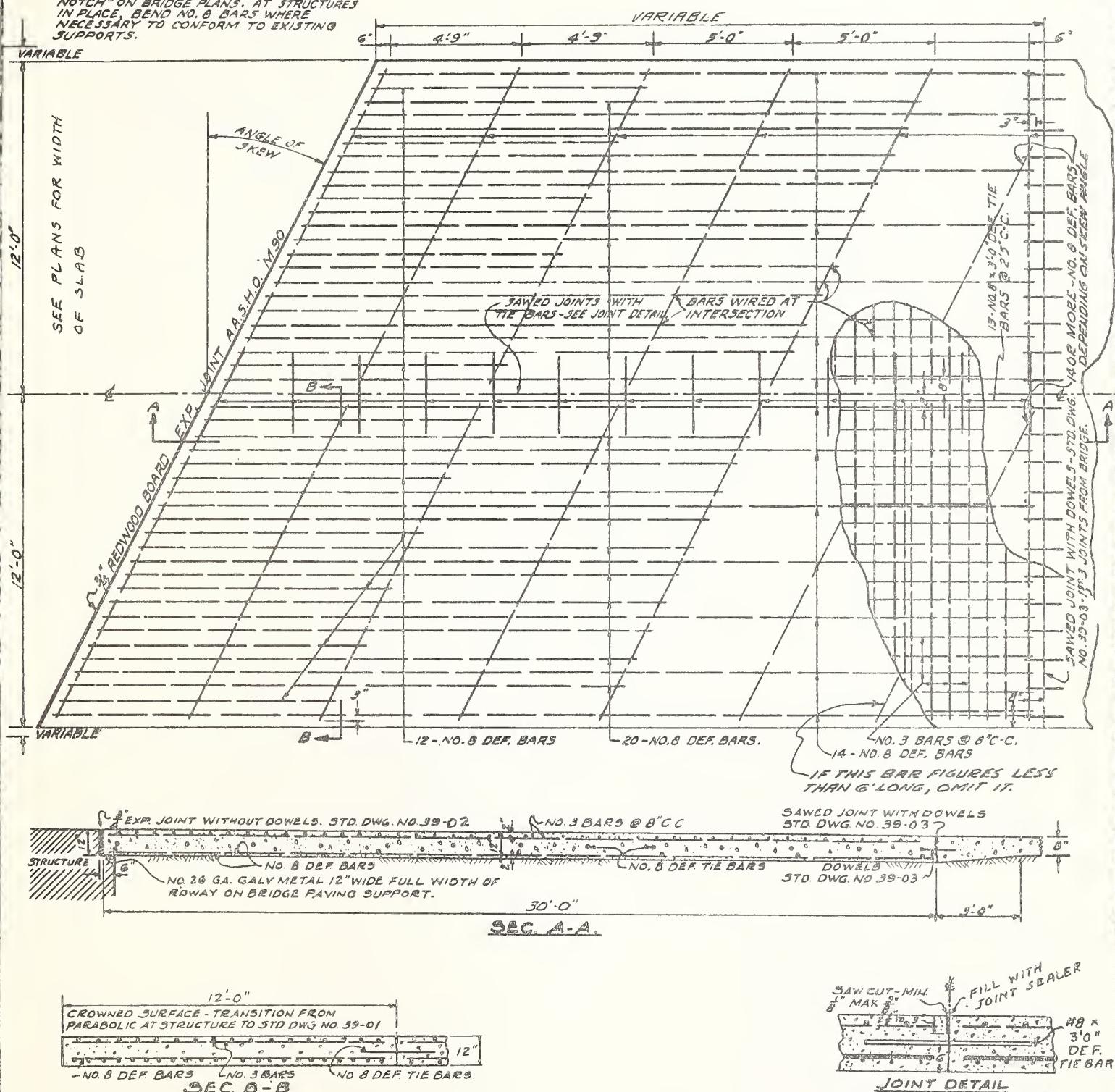
STANDARD DRAWING NO. 39-13

**State Highway Commission
Helena, Montana**

P.C. CONCRETE PAVEMENT
SKEWED BRIDGE APPROACH PANEL

Approved
James S. Shultz 10-25-68
State Highway Engineer

NOTE: FOR SUPPORTS OF APPROACH PANELS AT STRUCTURES SEE "PAVING NOTCH" ON BRIDGE PLANS. AT STRUCTURES IN PLACE, BEND NO. 8 BARS WHERE NECESSARY TO CONFORM TO EXISTING SUPPORTS.



THE CONCRETE SHALL BE STRUCK OFF TO AN ELEVATION 3" ABOVE SUBGRADE. THE NO. 8 STEEL BAR MAT SHALL BE PLACED THEREON IN ACCORDANCE WITH SEC. 47 OF THE STANDARD SPECIFICATIONS, AND TAMPED TO THE DESIGNATED ELEVATION. THE NO. 3 STEEL BAR MAT SHALL BE PLACED TO THE DESIGNATED ELEVATION IN A SIMILAR MANNER AFTER THE SLAB HAS BEEN STRUCK OFF TO AN ELEVATION 10" ABOVE SUBGRADE.

THE BRIDGE APPROACH PANEL WILL BE INCLUDED IN THE QUANTITY OF CONCRETE PAVEMENT ON THE ROADWAY AND NO ADDITIONAL PAYMENT WILL BE ALLOWED BECAUSE OF REINFORCEMENT AND INCREASED THICKNESS.

THE 1/4" EXPANSION JOINT MATERIAL AT THE BRIDGE END SHALL BE ANCHORED WITH NAILS.

STEEL BARS SHALL CONFORM TO "INTERMEDIATE GRADE" REINFORCING STEEL, A.A.S.H.O. M 31 & M 137 AND SEC. 47 OF THE STANDARD SPECIFICATIONS. THE COST OF THE STEEL BARS, THE 26 GAGE GALVANIZED METAL, THE EXPANSION JOINT MATERIAL, THE JOINT SEALER AND SUPPORTING DEVICES SHALL BE INCLUDED IN THE UNIT PRICE BID PER SQUARE YARD OF P. C. CONCRETE PAVEMENT.

WHEN CALLED FOR, CONSTRUCT APPROACH PANEL TO BRIDGE OR STRUCTURE WIDTHS SHOWN ON THE PLANS, SYMMETRICAL ABOUT CENTERLINE.



REVISED 7-9-68
EFFECTIVE 11-1-68

10-25-68
1-1-69

STANDARD DRAWING NO. 54-01

State Highway Commission
Helena, Montana

Approved
Loring Blattner 9-22-68
State Highway Engineer

DESCRIPTION OF BEDDING CLASSES

CLASS A CONCRETE CRADLE BEDDING. THE LOWER PART OF THE PIPE EXTERIOR SHALL BE BEDDED IN A CONTINUOUS CRADLE CONSTRUCTED OF 2000 POUND CONCRETE OR BETTER, HAVING A MINIMUM THICKNESS UNDER THE PIPE OF ONE-FOURTH THE NOMINAL INSIDE DIAMETER AND EXTENDING UP THE SIDES OF THE PIPE FOR A HEIGHT EQUAL TO ONE-FOURTH OF THE OUTSIDE DIAMETER. THE CRADLE SHALL HAVE A WIDTH AT LEAST EQUAL TO THE OUTSIDE DIAMETER OF THE PIPE PLUS 8" AND IT SHALL BE CONSTRUCTED MONOLITHICALLY WITHOUT HORIZONTAL CONSTRUCTION JOINTS.

CLASS B BEDDING. (1) THIS CLASS OF BEDDING FOR EMBANKMENT CONDITION IS APPLICABLE ONLY WHEN THE PROJECTION RATIO IS NOT GREATER THAN 0.7. THE PIPE SHALL BE CAREFULLY BEDDED ON FINE GRANULAR MATERIALS OVER AN EARTH FOUNDATION, ACCURATELY SHAPED BY MEANS OF A TEMPLATE TO FIT THE LOWER PART OF THE PIPE EXTERIOR FOR AT LEAST 10% OF THE CULVERT OVERALL HEIGHT. COMPACTABLE SOIL MATERIAL SHALL THEN BE RAMMED AND TAMPED IN LAYERS NOT MORE THAN 6" THICK, AROUND THE PIPE FOR THE REMAINDER OF THE LOWER 20% OF ITS HEIGHT. BACKFILLING TO THE TOP OF THE PIPE SHALL CONFORM WITH THE APPLICABLE PROVISIONS OF THE STANDARD SPECIFICATIONS.

(2) FOR TRENCH CONDITIONS, THE CULVERT IS PLACED AS DESCRIBED IN B(1) EXCEPT THAT THE EARTH FOUNDATION NEEDS TO BE SHAPED TO FIT THE LOWER PART OF THE CULVERT EXTERIOR FOR A WIDTH OF AT LEAST 60% OF THE CULVERT BREADTH. THEN THE REMAINDER OF THE CULVERT IS ENTIRELY SURROUNDED TO A HEIGHT OF AT LEAST 12" ABOVE ITS TOP BY GRANULAR MATERIAL PLACED BY HAND TO FILL ALL SPACES UNDER AND ADJACENT TO THE CULVERT. THE FILL IS TAMPED THOROUGHLY ON EACH SIDE AND UNDER THE CULVERT AS FAR AS PRACTICABLE IN LAYERS NOT TO EXCEED 6" IN THICKNESS.

CLASS B-1 BEDDING. IN THIS TYPE OF INSTALLATION, SOMETIMES CALLED THE IMPERFECT TRENCH METHOD, THE PIPE CULVERT SHALL BE FIRST INSTALLED IN ACCORDANCE WITH THE REQUIREMENTS OF B(2). THEN THE FILL SHALL BE COMPACTED AT EACH SIDE OF THE PIPE FOR A LATERAL DISTANCE EQUAL TO TWICE THE OUTSIDE DIAMETER OR 12", WHICH EVER IS LESS, AND CARRIED UP TO AN ELEVATION EQUAL TO THE OUTSIDE DIAMETER OF THE PIPE PLUS 12", ABOVE THE TOP OF THE PIPE. NEXT A TRENCH EQUAL IN WIDTH TO THE OUTSIDE DIAMETER OF THE PIPE SHALL BE DUG IN THE FILL DIRECTLY OVER THE CULVERT, DOWN TO AN ELEVATION 12" ABOVE THE TOP OF THE PIPE. CARE SHALL BE EXERCISED TO KEEP THE SIDES AS VERTICAL AS POSSIBLE. AFTER THE TRENCH IS EXCAVATED, IT SHALL BE REFILLED WITH LOOSE, HIGHLY COMPRESSIBLE SOIL MATERIAL. STRAW, HAY, LEAVES, BRUSH OR SANDSTUFT MAY BE USED TO FILL THE LOWER ONE-FOURTH TO ONE-THIRD OF THE TRENCH IN ORDER TO INSURE HIGH COMPRESSIBILITY OF THIS BACKFILL. THE BACKFILL OF STRAW, HAY, ETC. SHALL NOT BE CARRIED CLOSER THAN 10' TO THE OUTSIDE SLOPE OF THE FILL; THE OUTSIDE 10' SHALL BE COMPOSED OF IMPERVIOUS MATERIAL, THOROUGHLY COMPACTED. AFTER THE BACKFILL IS COMPLETED, THE BALANCE OF THE FILL SHALL BE CONSTRUCTED BY NORMAL METHODS UP TO THE FINISHED GRADE OF EMBANKMENT.

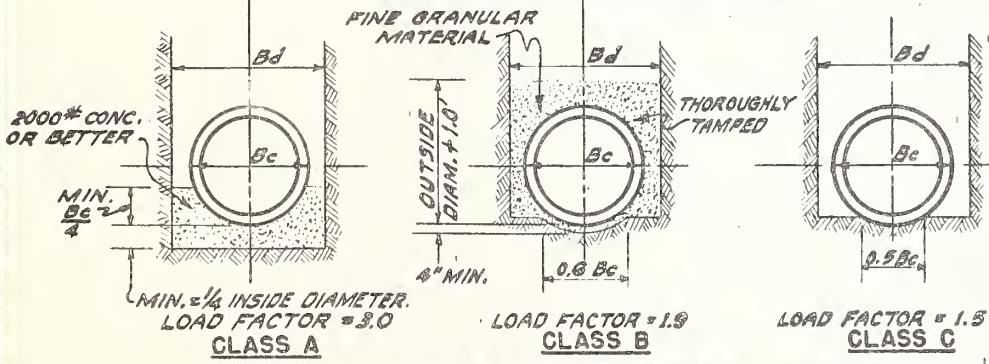
CLASS C BEDDING. FOR PROJECTING EMBANKMENT CULVERT, THIS METHOD OF BEDDING IS BEDDED WITH "ORDINARY" CARE IN AN EARTH FOUNDATION SHAPED TO FIT THE LOWER PART OF THE CULVERT EXTERIOR WITH REASONABLY CLOSENESS FOR AT LEAST 10% OF ITS OVERALL HEIGHT (FOR AT LEAST 50% OF THE CULVERT BREADTH IN THE CASE OF THE TRENCH CULVERT). THE REMAINDER OF PIPE SHALL BE SURROUNDED BY MATERIAL PLACED BY HAND TO FILL COMPLETELY ALL SPACES UNDER AND ADJACENT TO THE PIPE. BACKFILLING TO THE TOP SHALL THEN BE COMPLETED AS SPECIFIED IN THE STANDARD SPECIFICATIONS.

IF THE CULVERT IS PLACED ON ROCK FOUNDATIONS, PROJECTING EMBANKMENT CULVERT PIPES ARE BEDDED ON AN EARTH CUSHION HAVING A

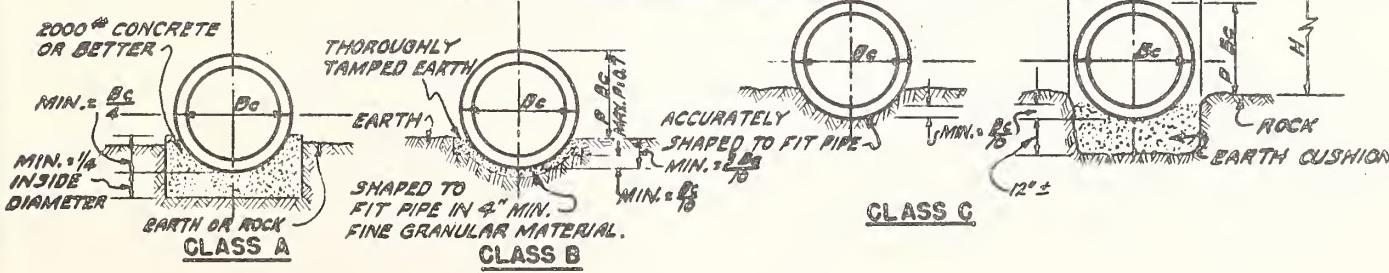
MINTUM ALLOWABLE THICKNESS OF 12" AND WITH THE EARTH FOUNDATION CAREFULLY SHAPED AND FILLED AROUND THE CULVERT THE SAME AS ORDINARY PROJECTING EMBANKMENT BEDDING ON AN EARTH FOUNDATION.

CULVERT BEDDING

TYPES OF TRENCH BEDDING



TYPES OF EMBANKMENT BEDDING



WHEN NATURAL GROUND MATERIAL SIMULATES BEDDING MATERIAL, NO SPECIAL BEDDING MATERIAL NEED BE USED. USE CLASS "C" UNLESS OTHERWISE NOTED ON PLANS.

REVISED	5-9-68	11-20-68	12-5-69
EFFECTIVE	11-1-68	1-1-69	1-1-70

STANDARD DRAWING NO.

56-01

State Highway Commission

Helena, Montana

THICKNESS FOR CORRUGATED STEEL PIPE

$2\frac{1}{3} \times \frac{1}{2}$ CORRUGATION H-20 LOADING

Approved

Lewis W. Chittid
State Highway Engineer

THICKNESS(CIRCULAR CORRUGATED STEEL PIPE)					
SEAM FABRICATION		RIVETED, WELDED OR HELICALLY FABRICATED			
AREA (SQ. FT.)	DIA. (INCHES)	HEIGHT OF COVER (FEET)			
		0.064"	0.079"	0.109"	0.138"
1.2	15	67	73	93	98
1.8	18	47	55	70	82
2.4	21	37	43	50	58
3.1	24	30	33	40	48
4.9	30	24	25	29	33
7.1	36	21	22	24	26
9.6	42		20	21	23
12.6	48		19	20	21
15.9	54			19	20
19.6	60			18	19
23.8	66				18
28.3	72				18
33.2	78				18
38.5	84				18

THICKNESS INCHES	GAGE (APPROX.)
0.064"	16
0.079"	14
0.109"	12
0.138"	10
0.168"	8

THICKNESS(ELONGATED CORRUGATED STEEL PIPE)					
SEAM FABRICATION		RIVETED, WELDED OR HELICALLY FABRICATED			
AREA (SQ. FT.)	DIA. (INCHES)	HEIGHT OF COVER (FEET)			
		0.064"	0.079"	0.109"	0.138"
1.2	15	67	73	93	98
1.8	18	47	55	70	82
2.4	21	37	43	50	58
3.1	24	30	33	40	48
4.9	30	34	36	47	49
7.1	36	28	30	39	41
9.6	42		38	43	46
12.6	48		37	40	42
15.9	54			38	41
19.6	60			34	38
23.8	66				35
28.3	72				38
33.2	78				31
38.5	84				25
					20

NOTES:

USE SPECIAL DESIGN FOR STRUCTURES
WITH HEIGHTS OF COVER EXCEEDING
THESE TABLES.

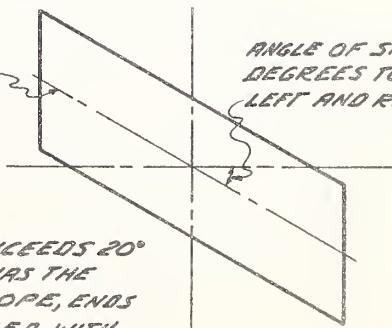
MINIMUM COVER 2 FT.

CUT END OF CULVERT
PARALLEL TO % OF
ROAD WHEN SPECIFIED

ANGLE OF SKEN
DEGREES TO
LEFT AND RIGHT

NOTE:

WHEN SKEN ANGLE EXCEEDS 20°
AND THE PIPE ARCH HAS THE
ENDS CUT TO FIT A SLOPE, ENDS
SHALL BE REINFORCED WITH
MASONRY.



REVISED EFFECTIVE	8-1-67 8-1-67	11-20-68 1-1-69	12-5-69 1-1-70		STANDARD DRAWING NO. 56-02
State Highway Commission Helena, Montana				THICKNESS FOR CORRUGATED STEEL PIPE 3x1 CORRUGATION H-20 LOADING	Approved <i>Louis M. Buttrill</i> State Highway Engineer

FILL HEIGHT OF CIRCULAR CORRUGATED STEEL PIPE						
SEAM FABRICATION		SPOT WELDED				
AREA (SQ. FT.)	DIA. (INCHES)	5/16" RIVETS OR HELICAL		3/8" RIVETS OR HELICAL FABRICATION		
		HEIGHT OF COVER(FT.)	0.064"	0.079"	0.109"	0.138"
13	48	23	27	30	34	38
16	54	20	24	26	29	32
20	60	19	22	24	26	28
24	66	17	20	22	23	25
28	72	15	20	21	22	23
33	78	14	19	20	21	22
38	84		19	19	20	21
44	90		18	19	19	20
50	96			18	19	20
57	102			18	19	19
64	108			18	19	19
71	114				18	19
78	120				18	19

FILL HEIGHT FOR ELONGATED CORRUGATED STEEL PIPE						
SEAM FABRICATION		SPOT WELDED				
AREA (SQ. FT.)	DIA. (INCHES)	5/16" RIVETS OR HELICAL		3/8" RIVETS OR HELICAL		
		HEIGHT OF COVER(FT.)	0.064"	0.079"	0.109"	0.138"
10						
13	48	23	34	52	54	57
16	54	20	29	47	48	50
20	60	19	26	42	43	45
24	66	17	24	38	39	41
28	72	15	22	35	36	38
33	78	14	21	32	33	35
38	84		19	30	31	32
44	90		18	28	29	30
50	96			26	27	28
57	102			25	25	26
64	108			23	24	25
71	114				22	24
78	120				21	22

-NOTES-

USE SPECIAL DESIGN FOR STRUCTURES WITH
HEIGHTS OF COVER EXCEEDING THESE TABLES.

IF SKEW IS REQUIRED SEE STD. DWG. NO. 56-01

MINIMUM COVER - 2 FT.

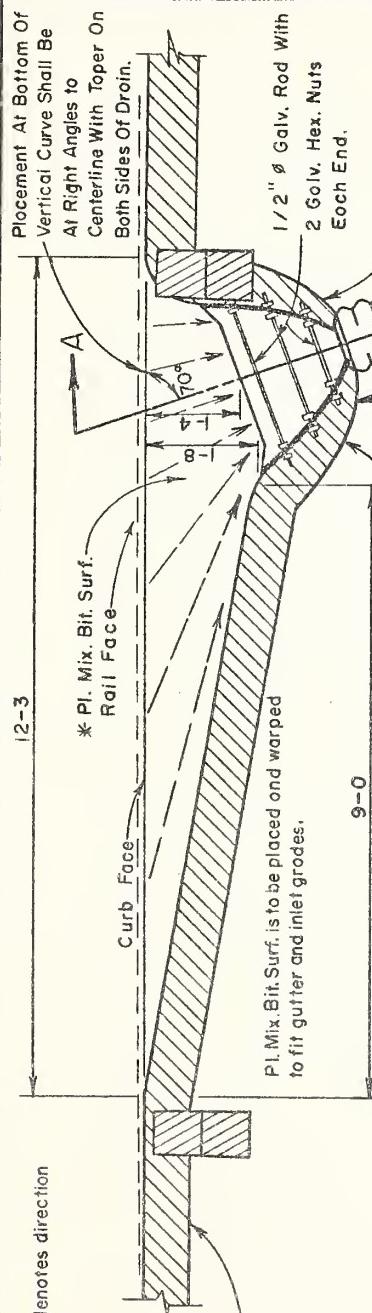
REVISED 9-17-68 11-1-68 5-20-69 12-8-69
EFFECTIVE 11-1-68 11-1-69 7-1-69 1-1-70

Standard Drawing No. 56-10

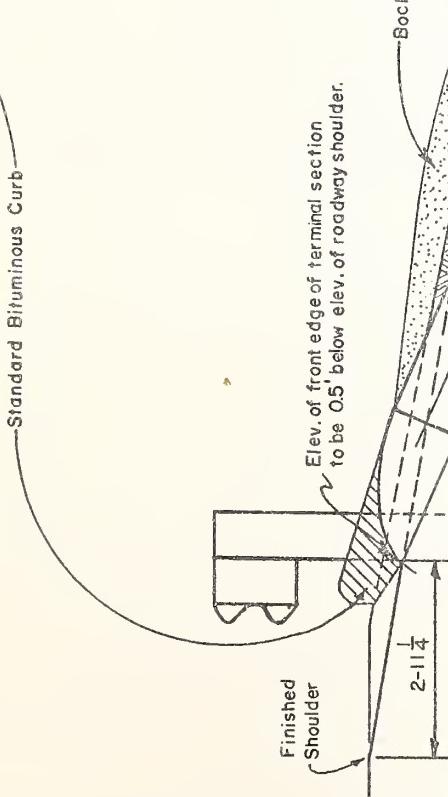
State Highway Commission
Helena, Montana

EMBANKMENT PROTECTOR

Approved
Lewis M. Phillips
State Highway Engineer
10-9-67



PLAN VIEW OF INLET



GENERAL NOTES

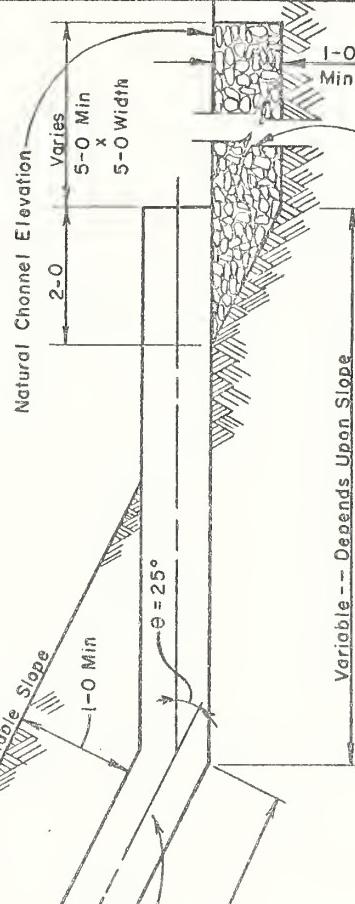
Conduit May Be Either Circumferential Or Helical.
 θ And Δ Shall Be As Shown Unless Otherwise Specified In The Plans Or By The Engineer.

Contractor Shall Not Order Pipe Until Directed By The Engineer.
Flared End Section May Be Called For On Outlet End When Specified On Plans.

Embankment Protector Shall Be Bid As Unit Price Bid Per Lin.Ft.

The 12" Flared End Section, 12" C.M.P. And Bends, Are To Be Included In Total Length Of Embankment Protector.

All Other Hardware Shall Be Included In The Unit Price Bid Per Lin. Ft. Of Embankment Protector.
* Included With Roadway Quantities.



Approx. $\frac{1}{2}$ Cu. Yd. Type 3 Bank Protection--To Be Placed In Manner Best Suited To Fit Existing Conditions.

OUTLET DETAIL

REVISED	8-1-67	11-20-68	12-8-69
EFFECTIVE	8-1-67	1-1-69	1-1-70

STANDARD DRAW NO. 57-01

State Highway Commission
Helena, Montana

THICKNESS FOR CORRUGATED STEEL PIPE ARCH

H-20 LOADING

Approved
Lewis J. Buttress
State Highway Engineer

THICKNESS - CORRUGATED STEEL PIPE ARCH

2 $\frac{3}{8}$ " x $\frac{1}{2}$ " CORRUGATION RIVET, WELD OR HELICALLY FABRICATED

AREA (Sq. Ft.)	SPAN (In.)	RISE (In.)	DIA. OF PIPE OF EQ. PER.	MINIMUM THICKNESS	LAYOUT DIM. B (In.)	MAXIMUM COVER (Ft.)	MINIMUM COVER (Ft.)
1.1	18	11	15	0.064	9 $\frac{1}{2}$	13	2
1.6	22	13	18	0.064	9 $\frac{3}{4}$	12	2
2.2	25	16	21	0.064	5 $\frac{1}{4}$	10	2
2.8	29	18	24	0.064	5 $\frac{1}{2}$	9	2
4.4	36	22	30	0.064	6 $\frac{1}{4}$	9	2
6.4	43	27	36	0.064	7	7	2
8.7	50	31	42	0.079	8	7	2
11.4	58	36	48	0.109	9 $\frac{1}{4}$	7	2
14.3	65	40	54	0.109	10 $\frac{1}{2}$	7	2
17.6	72	44	60	0.138	11 $\frac{1}{4}$	7	2
21.3	79	49	66	0.168	13 $\frac{1}{4}$	7	2
25.3	85	54	72	0.168	14 $\frac{1}{2}$	7	2

EQUIVALENT GAGE NUMBERS	
GAGE	THICKNESS
16	0.064
14	0.079
12	0.109
10	0.138
8	0.168

NOTE: Use special design for structures with heights of cover exceeding these tables.

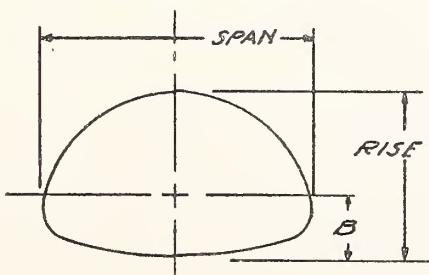
THICKNESS - CORRUGATED STEEL PIPE ARCH

3" x 1" CORRUGATION RIVET, WELD OR HELICALLY FABRICATED

AREA (Sq. Ft.)	SPAN (In.)	RISE (In.)	DIA. OF PIPE OF EQ. PER.	MINIMUM THICKNESS	LAYOUT DIM. B (In.)	MAXIMUM COVER (Ft.)	MINIMUM COVER (Ft.)
11.4	58	36	48	0.064	13	12	2
14.3	65	40	54	0.064	14 $\frac{3}{4}$	12	2
17.6	72	44	60	0.064	16 $\frac{1}{2}$	12	2
22	73	55	66	0.064	21	15	2
26	81	59	72	0.079	21 $\frac{1}{2}$	15	2
31	87	63	78	0.079	22	14	2
35	95	67	84	0.109	22 $\frac{1}{2}$	12	2
40	103	71	90	0.109	23	11	2.5
46	112	75	96	0.109	23 $\frac{1}{2}$	10	2.5
52	117	79	102	0.109	24	10	2.5
58	128	83	108	0.138	24 $\frac{1}{2}$	10	2.5

NOTES: Use special design for structures with heights of cover exceeding these tables.
If skew is required see Std. Dwg N^o. 60-02

PIPE-ARCH SHAPE



NOTE: See Std Dwg # 73-08 if cutoff wall is required.

REVISED 6-16-67 11-20-68
EFFECTIVE 8-1-67 1-1-69

STANDARD DRAWING NO. 59 01

State Highway Commission
Helena, Montana

GAGE TABLE FOR STEEL STRUCTURAL PLATE PIPE
& PIPE-ARCH H-20 LIVE LOAD

Approved
Leroy C. Gifford
ACTING State Highway Engineer

GAGES FOR STRUCTURAL PLATE PIPE 6" x 2" CORRUGATION
(NOT ELONGATED) 4 - 3/4" A-325 BOLTS/FT.

AREA (SQ.FT.)	DIA. (IN.)	HEIGHT OF COVER (FEET)							
		MIN. (FT.)	12 GA.	10 GA.	8 GA.	7 GA.	5 GA.	3 GA.	1 GA.
20	60	2	42	36	32	30	28	24	20
24	66	2	36	42	48	52	58	64	71
28	72	2	33	36	41	44	49	54	59
33	78	2	29	32	36	38	42	48	50
38	84	2	27	30	33	34	37	40	43
44	90	2	24	27	29	31	33	36	39
50	96	2	24	25	27	29	31	33	35
57	102	2	22	24	26	26	29	30	32
64	108	2.5	22	23	24	25	26	28	29
71	114	2.5	20	22	23	23	25	26	27
78	120	2.5	20	21	22	23	24	25	26
87	126	3	20	21	22	22	23	24	25
95	132	3	19	20	21	21	22	23	24
104	138	3	19	20	20	21	22	22	23
113	144	3	17	19	20	20	21	21	22
123	150	3	17	19	20	20	21	21	22
133	156	4	16	19	20	20	20	21	21
143	162	4	15	19	19	19	20	20	21
154	168	4	15	18	19	19	19	20	20
165	174	4	15	18	19	19	19	20	20
177	180	4	14	18	18	18	19	19	19
203	192	4		18	18	18	19	19	19
213	198	5		18	18	18	19	19	19
230	204	5		18	18	18	19	19	19
240	210	5			18	18	18	18	19
258	216	5			18	18	18	18	19
287	228	5			18	18	18	18	18
310	240	5				18	18	18	18
352	252	5					18	18	18

GAGES FOR STRUCTURAL PLATE PIPE 6" x 2" CORRUGATION
(ELONGATED) 4 - 3/4" A-325 BOLTS/FT.

AREA (SQ.FT.)	DIA. (IN.)	HEIGHT OF COVER (FEET)							
		MIN. (FT.)	12 GA.	10 GA.	8 GA.	7 GA.	5 GA.	3 GA.	1 GA.
20	60	2	42	36	31	29	26	22	20
24	66	2	36	42	48	52	58	64	71
28	72	2	33	36	41	44	49	54	59
33	78	2	29	32	36	38	42	48	50
38	84	2	27	30	33	34	37	40	43
44	90	2	24	27	29	31	33	36	39
50	96	2	24	25	27	29	31	33	35
57	102	2	22	24	26	26	29	30	32
64	108	2.5	22	23	24	25	26	28	29
71	114	2.5	20	22	23	23	25	26	27
78	120	2.5	20	21	22	23	24	25	26
87	126	3	20	21	22	22	23	24	25
95	132	3	19	20	21	21	22	23	24
104	138	3	19	20	20	21	22	22	23
113	144	3	17	19	20	20	21	21	22
123	150	3	17	19	20	20	21	21	22
133	156	4	16	19	20	20	20	21	21
143	162	4	15	19	19	19	20	20	21
154	168	4	15	18	19	19	19	20	20
165	174	4	15	18	19	19	19	20	20
177	180	4	14	18	18	18	19	19	19
203	192	4		18	18	18	19	19	19
213	198	5		18	18	18	19	19	19
230	204	5		18	18	18	19	19	19
240	210	5			18	18	18	18	19
258	216	5			18	18	18	18	19
287	228	5			18	18	18	18	18
310	240	5				18	18	18	18
352	252	5					18	20	23

GAGES FOR STRUCTURAL PLATE PIPE-ARCH
A - 3/4" A-325 BOLTS/FT.

AREA (SQ.FT.)	SPAN (FT-M)	RISE (FT-IN)	INC (FT-IN)	CORNER RADUS (IN.)	DIA. OF PIPE OF EQ. (IN.)	MIN. PIPE GAUGE PER	MIN. HT. OF COVER (FT.)	MAX. HT. OF COVER (FT.)
22	6-1	4-7	2-4	18	66	12	2.0	15
26	6-9	4-11	2-5	18	72	12	2.0	15
31	7-3	5-3	2-1	18	78	12	2.0	13
35	7-11	5-7	2-2	18	84	12	2.0	12
40	8-7	5-11	2-4	18	90	12	2.5	11
46	9-4	6-3	2-5	18	96	12	2.5	10
52	9-9	6-7	2-2	18	102	12	2.5	10
58	10-8	6-11	2-9	18	108	12	2.5	9
64	11-5	7-3	2-10	18	114	12	2.5	8
71	11-10	7-7	2-6	18	120	12	2.5	7
78	12-6	7-11	2-8	18	126	12	2.5	6
85	12-10	8-4	2-4	18	132	12	2.5	6
106	14-0	9-8	3-4	31	144	12	2.5	12
124	15-4	10-4	3-6	31	156	10	2.5	11
143	16-6	11-0	3-5	31	168	10	3.5	11
163	17-11	11-8	3-8	31	180	8	3.5	8
185	19-3	12-4	3-10	31	192	8	3.5	9
208	20-5	13-0	3-9	31	204	7	3.5	7

NOTE: USE SPECIAL DESIGN FOR STRUCTURES WITH
HEIGHT OF COVER EXCEEDING THESE TABLES.

SEE STANDARD DRAWING NO. 59-03, 59-05
& 73-08 REGARDING END TREATMENT

NOTE:
WHEN SKEW ANGLE
EXCEEDS 20° AND THE
PIPE ARCH HAS THE
ENDS CUT TO FIT A
SLOPE, END SHALL BE
REINFORCED WITH
MASONRY

CUT END OF CULVERT
PARALLEL TO % OF
ROAD WHEN SPEC.

% OF ROAD

ANGLE OF SKEW
DEGREES TO
RIGHT OR LEFT

CUT END OF CULVERT
PARALLEL TO % OF
ROAD WHEN SPEC.

REVISED 9-1-66 / 22-68
EFFECTIVE 9-1-66 / 1-1-69

State Highway Commission
Helena, Montana

STANDARD DRAWING NO. 81-01

Approved

Permit by _____ 10-24-68
State Highway Engineer

WIRE FENCE - INTERSTATE TYPE

See Std. Dwg. No. 81-02

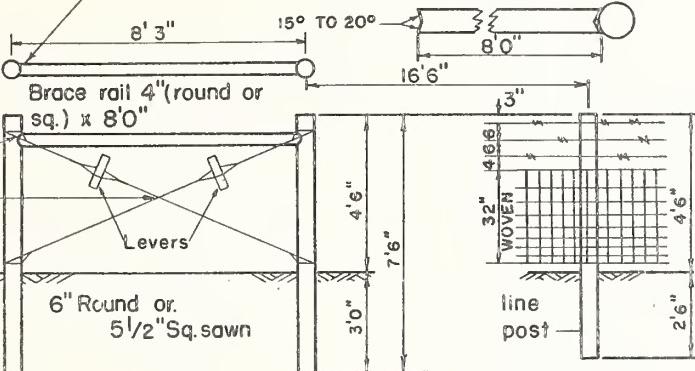
Nail rail to post with
2 to 4 20d galv. nails.

Brace rail to be notched as shown
prior to treatment.

When square post are
used, notching not
necessary.

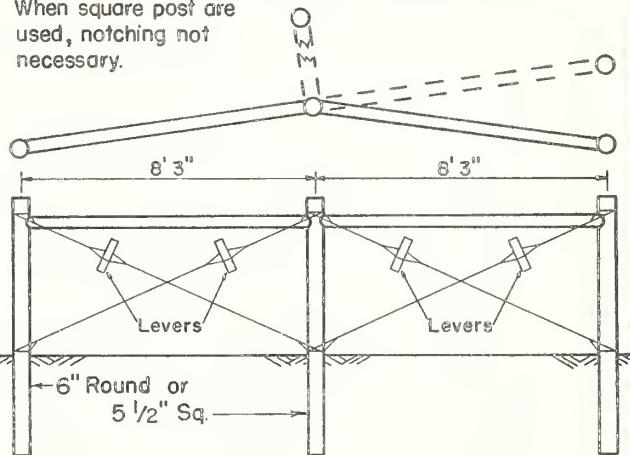
Do not dap
post for
brace rail.

Wires shall
not be inter-
woven at
 $\pm 3''$
point of
crossing.



SINGLE PANEL
For pull or stretching or
for end panel on run of
less than 400'

4" Min. round or
4"x 4" std. sq.

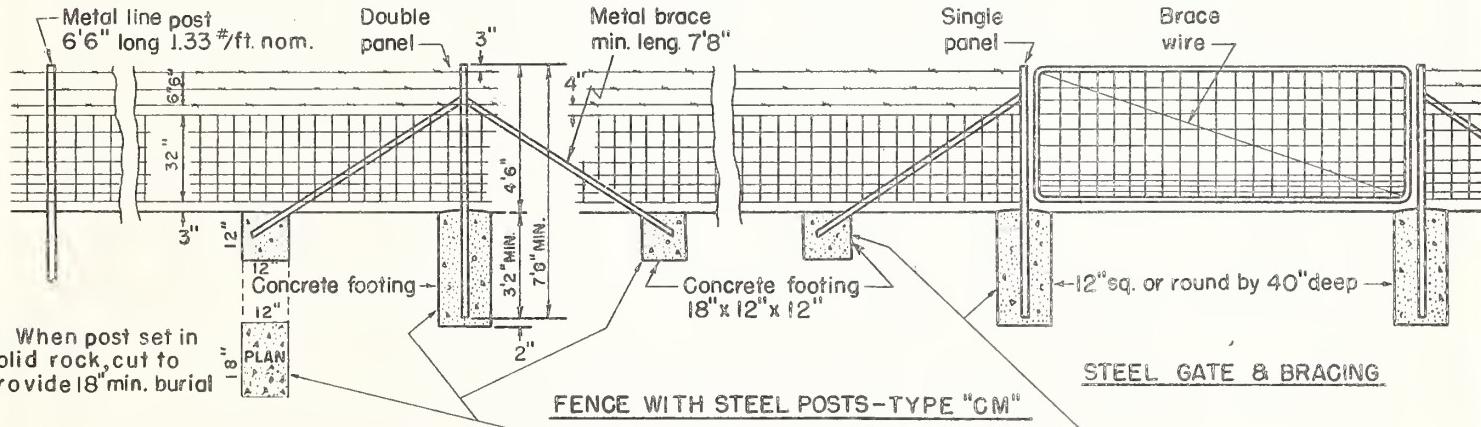


DOUBLE PANEL

For corners, pulling or stretching, and changes in
both horizontal and vertical alignment of more
than 14° or slope break of more than 14°.

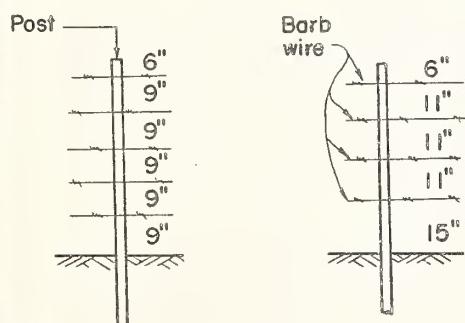
Except for horizontal angles less
than 30° use 2-single panels.

"STRAIGHT RUN" FENCE WITH WOOD POSTS-TYPE "CW"



FENCE WITH STEEL POSTS-TYPE "CM"

Each corner, end, gate and pull post and each
brace shall be set in concrete as shown.

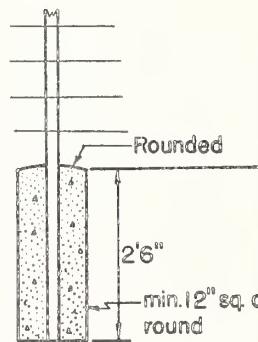


"M" indicates metal post.
"W" indicates wood post.
Braces, corners, deadman
and other features same
as "CW" and "CM" fence.

Wire stay half-
way between posts.
4.4" on "CB5"
4.2" on "CB4"

NOTE:

A deadman may be a precast concrete
block, a cast in place concrete block,
a rock or other approved object --
weighing at least 150 lbs -- and
covered at least 2 feet.
"Terminal Post" shall be at the end of
any run of wire or at any stretch panel.



Securely tie all wires to post.

METAL POST-CONC. FOOTING

TYPE "CB4" & "CB5" WIRE FENCE
Post spacing measured generally parallel to ground.

Line post shall normally be spaced 16' 6" apart. Also 16' 6" from brace
or panel posts.

24" wire stay to be placed halfway between posts, excepting panels on
"CM" and "CW" fence.

Maximum run between panels 330' for woven wire; 990' for barb wire.

Fence with wooden posts to have one metal post, in place of a wooden
line post, in each 500' run for lightning protection.

Type "CW" panels (wood) will be used on type "CM" fence instead of
steel panels when so specified.

NOTES:

All fence wire to be placed on pasture side of posts except that on
curves, the wire shall be placed on the outside of the curve.

In areas subject to high velocity winds and moving debris, wires may
all be placed on windward side of posts. Except on curves.

All concrete shall be class "F" or better.

Maximum bow in wood posts -- 2" in 7'.

REVISED 9-1-66 11-22-68
EFFECTIVE 9-1-66 1-1-69

STANDARD DRAWING NO. 81-02

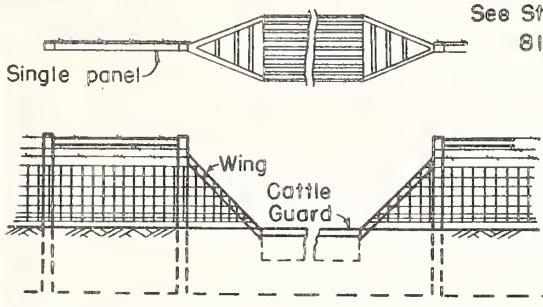
State Highway Commission
Helena, Montana

Approved

Louis C. Jones 10-24-68
State Highway Engineer

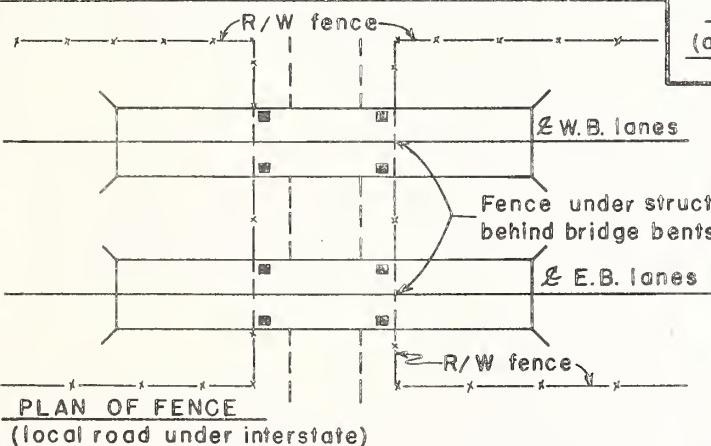
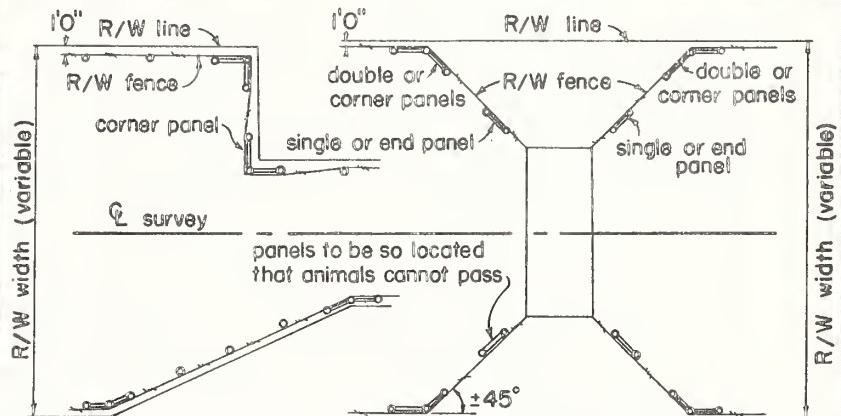
WIRE FENCE - INTERSTATE TYPE

See Std. Dwg. No.
81-01

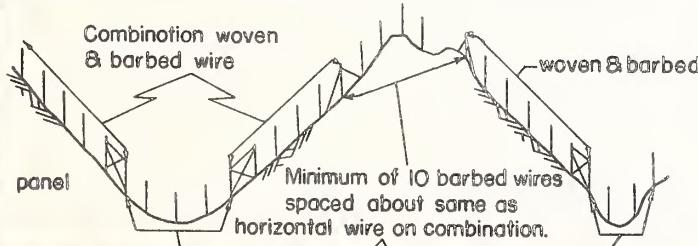


FENCE CONNECTION TO CATTLE GUARD

For detail of cattle guard see standard drawing.
Fence wire shall be securely fastened to the wings
and so arranged that animals cannot pass.

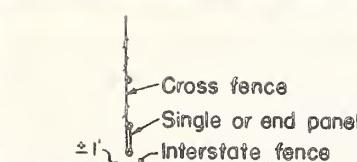


PLAN OF FENCE
(local road under interstate)

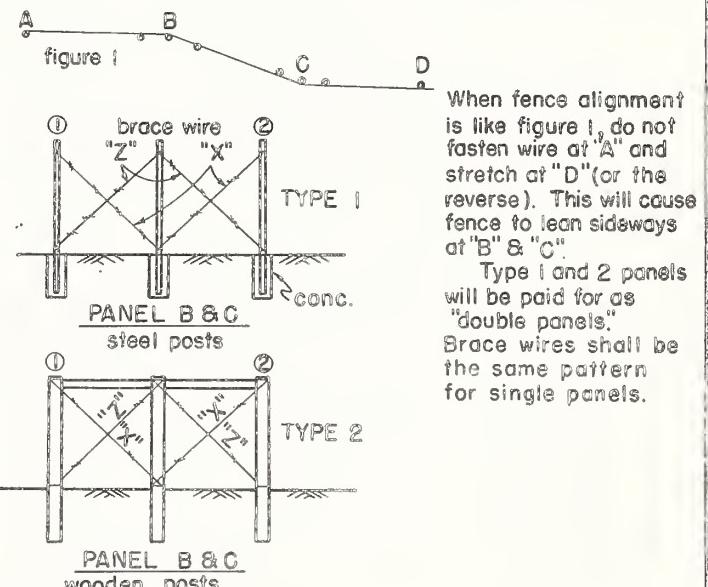


FENCE CONSTRUCTION ON SHARP VERTICAL CURVES

To avoid trying to conform woven wire to uneven terrain.



LAYOUT OF CROSS-FENCE CONNECTION

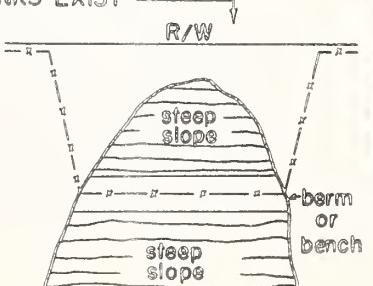
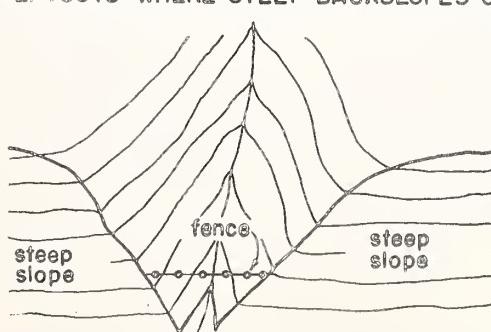
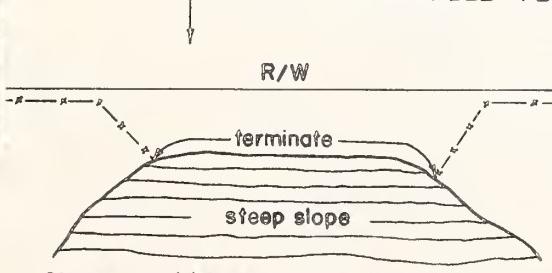


When using wooden posts (here the contractor will be permitted to use type 2 panel if he so elects) a double panel will be installed. When using steel posts, extra posts must be installed at ① and ②, 8'-10' from the center post. All posts must be the heavy type as for panels.

Brace wire "Z" may be double 9 gage wire twisted or 4 12 gage barbed wires twisted. Brace wire "X" shall be 6-9 gage wires or 12-12 gage wires twisted.

Stretching shall be done between "A" & "B" and "C" & "D" and "B" & "C" using post ① or ②, which ever is nearest. Wire between ① & ② in each panel to be stretched by hand or small tools. For horizontal angles of less than 30° use 2-single panels in place of one double panel.

PERMISSIBLE FENCE LAYOUTS WHERE STEEP BACKSLOPES OR BANKS EXIST





REVISED 9-1-66 11-25-68
EFFECTIVE 9-1-66 1-1-69

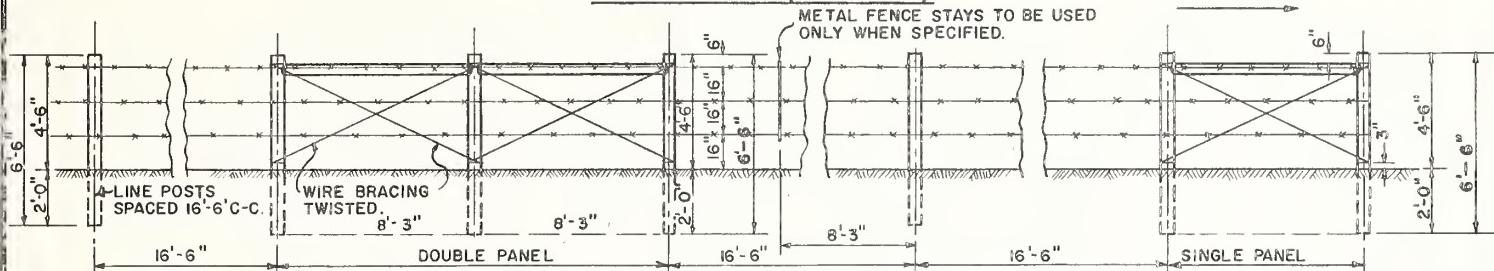
STANDARD DRAWING NO. 83-02

State Highway Commission
Helena, Montana

FARM FENCE

Approved
Loring Pettington 10-24-68
State Highway Engineer

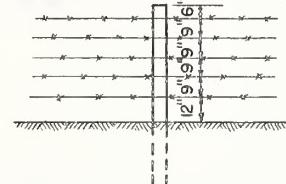
3 WIRE FENCE (TYPE F-3)



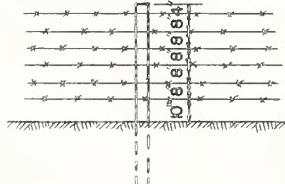
4 WIRE FENCE (TYPE F-4)

ALL WIRE SPACING SHOWN IS APPROXIMATE

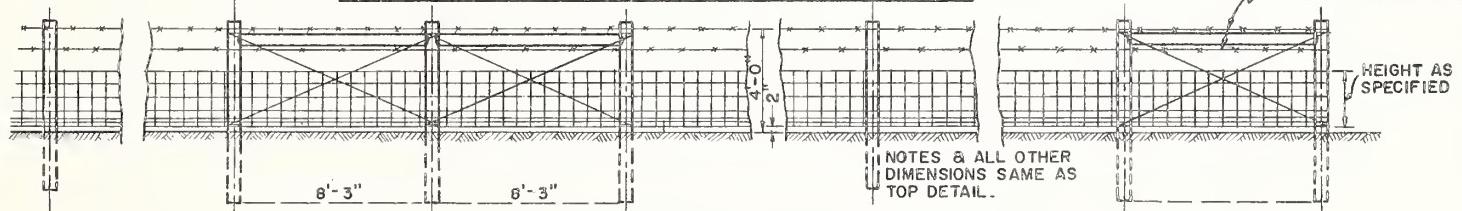
5 WIRE FENCE (TYPE F-5)



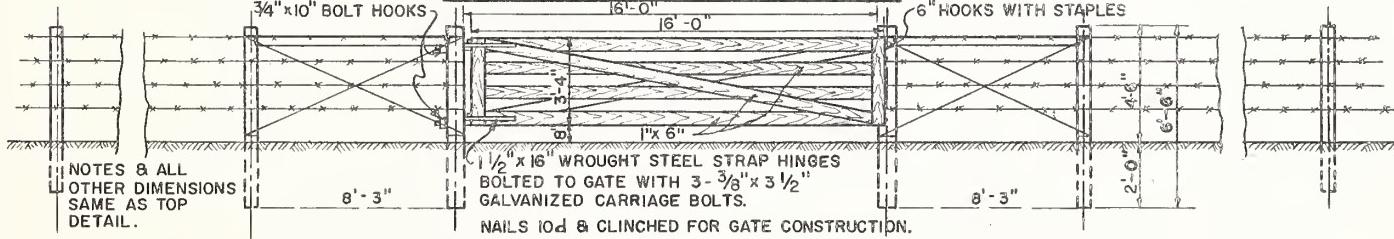
6 WIRE FENCE (TYPE F-6)



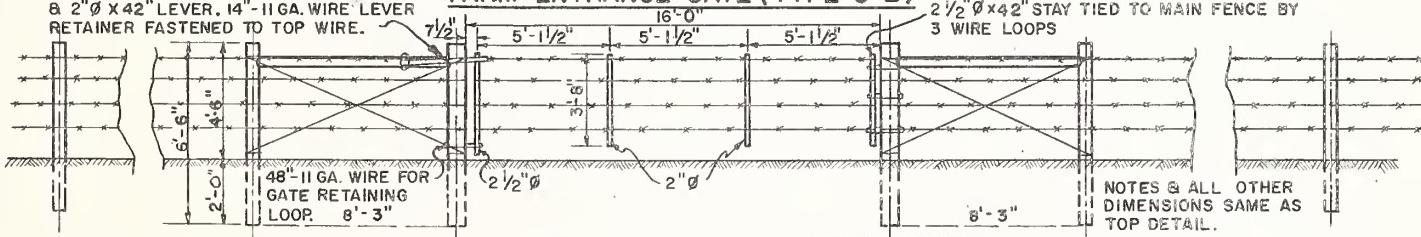
BARB WIRE & WOVEN WIRE FENCE (TYPE F-2)



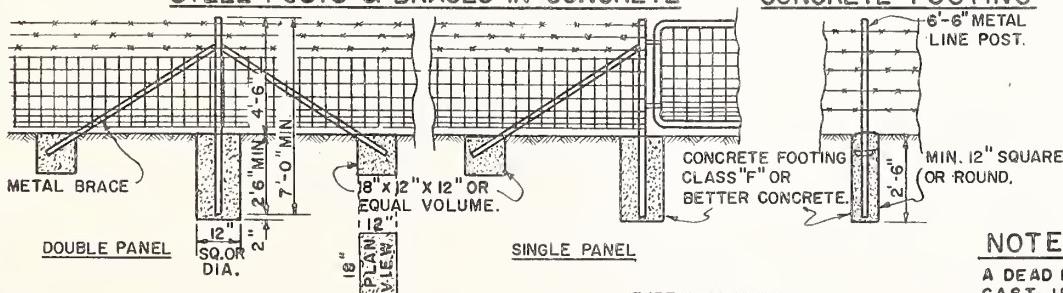
FARM ENTRANCE GATE (TYPE G-1)



FARM ENTRANCE GATE (TYPE G-2)



STEEL POSTS & BRACES IN CONCRETE



METAL LINE POSTS

6'-6" LONG, 1.33 LBS. PER FT,
NOMINAL FACTORY PAINTED OR
GALVANIZED.

CORNER, GATE & END POSTS

7'-0" LONG (NOMINAL)

TERMINAL POST

SHALL BE AT THE END OF ANY RUN OF
WIRE OR AT ANY STRETCH PANEL.

TYPE G-3 GATE
IS METAL.

A GOOD SUBSTANTIAL
GATE, COMMERCIALLY
AVAILABLE AND IN
GENERAL USE.

NOTE:

A DEAD MAN MAY BE A CONCRETE BLOCK, A
CAST-IN-PLACE CONCRETE BLOCK, A ROCK
OR OTHER APPROVED OBJECT, WEIGHING AT
LEAST 150 LBS., AND COVERED AT LEAST 2 FEET

NOTE: (STEEL POSTS)

EACH CORNER, END GATE, OR PULL POST
AND EACH BRACE SHALL BE SET IN CONCRETE
AND BRACED AS INDICATED.



Drawn 3-1-63

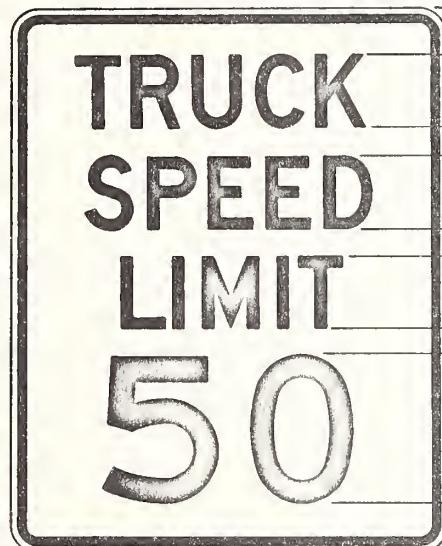
REVISED 9-16-64
EFFECTIVE 9-16-64

STANDARD DRAWING NO. 88-07

State Highway Commission
Helena, Montana

STANDARD R2-2A, R2-3A, & R2-12 SIGNS

Approved

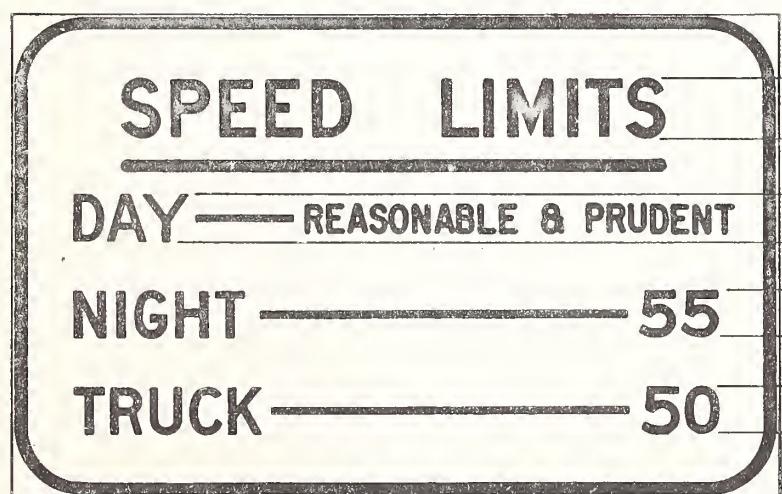
Lewis M. Bullard E-68
State Highway Engr.

R2-2A
48" X 60"
MARGIN = 3/4"
BORDER = 7/8"
CORNER RADIUS = 3"



R2-3A
48" X 60"
1" BORDER, NO MARGIN
REFLECTORIZED WHITE LEGEND
ON BLACK BACKGROUND

R2-2A & R2-12, BLACK LEGEND ON
A WHITE REFLECTORIZED BACKGROUND



R2-12
132" X 84"

NOTE:

CENTER 1 1/2" BAR BETWEEN LINES 1 & 2
DASHES IN LINES 2, 3, & 4 ARE 1" WIDE.
THE MARGIN IS 1/2" AND THE BORDER IS 2".
THE CORNER RADIUS IS 12".



Drawn 3-1-66 Revised 11-1-68 11-28-69
Effective 1-1-69 1-1-70

STANDARD DRAWING NO. 88-09

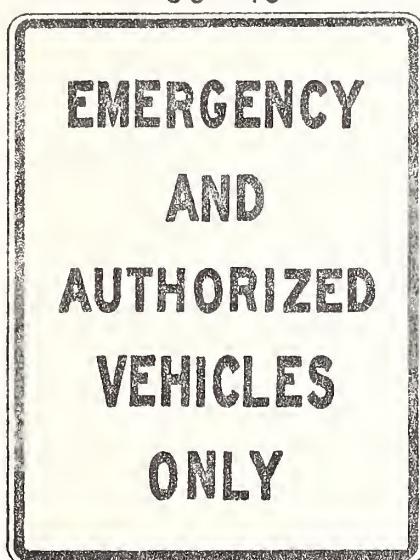
State Highway Commission
Helena, Montana

SIGNING OF MEDIAN U-TURNS

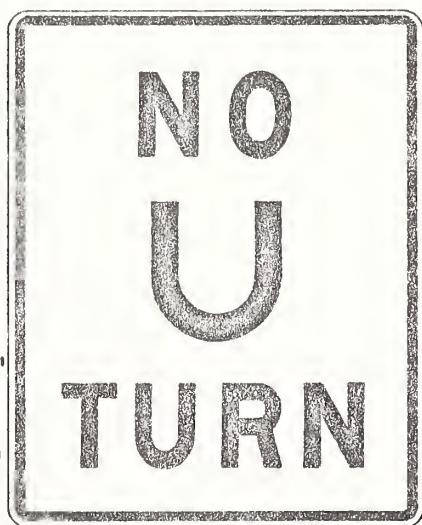
Approved
Lars J. Gustafson
State Highway Engineer

R3-10
36 x 48

R3-4 (OPTIONAL)
36 x 48



Margin = 5/8"
Border = 7/8"
Corner Radius = 2"

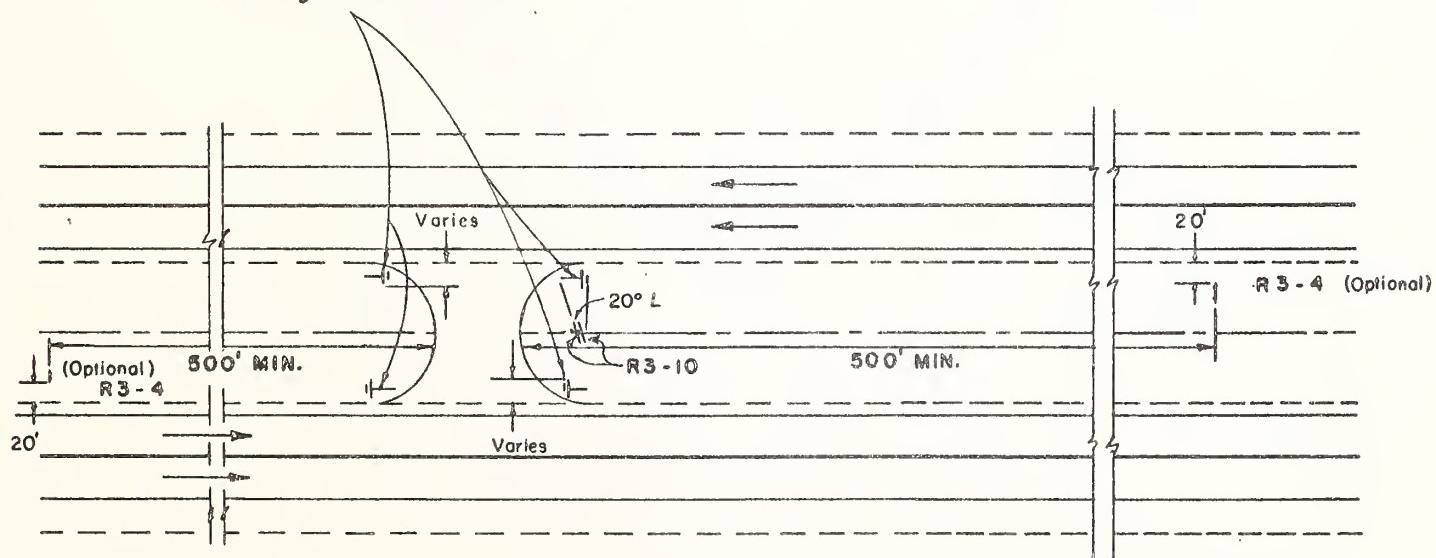


Note:

R3-4 and R3-10 Shall have black legend on White reflectorized background.

For median widths of 68 feet or less, R3-10 Signs shall be mounted back to back. They shall be placed at the centerline of the median and on the side of the U-turn away from the nearest interchange. Median widths greater than 68 feet will require separate installations on either side of the U-turn at specified clearance. For openings through median guard rails, the sign post shall be placed in line with guard rail post.

Design 'B' delineator as
specified in Standard
Drawing No. 88-91



U-TURN MEDIAN OPENINGS
(See Std. Dwg. 20-05)

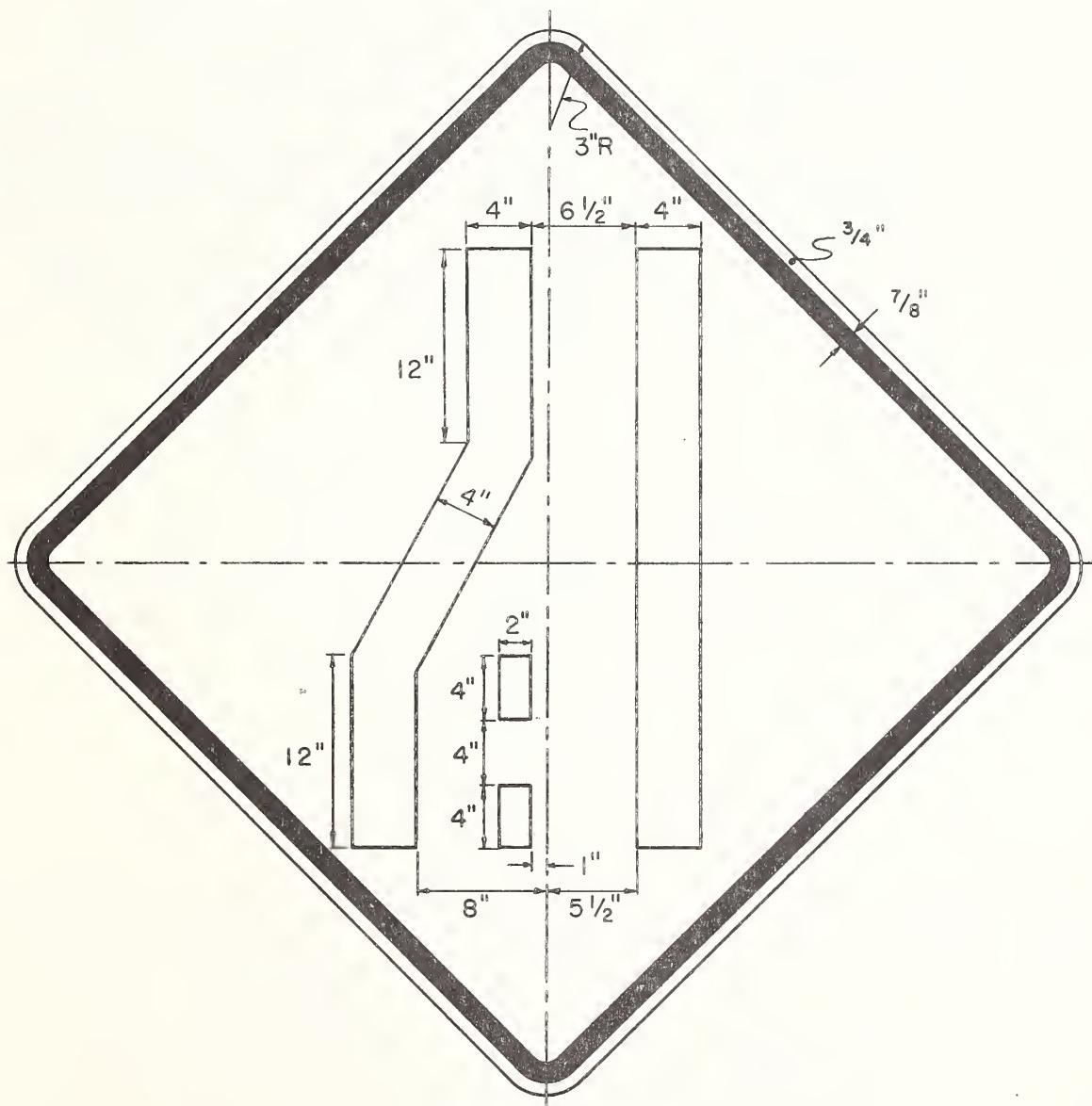
Drawn 3-1-63

REVISED
EFFECTIVE 3-1-63

STANDARD DRAWING NO. 88-16

State Highway Commission
Helena, Montana

STANDARD W4-2 WARNING SIGN

Approved
L. S. [Signature]
State Highway EngineerW4-2
48" X 48"

BLACK ON REFLECTORIZED YELLOW

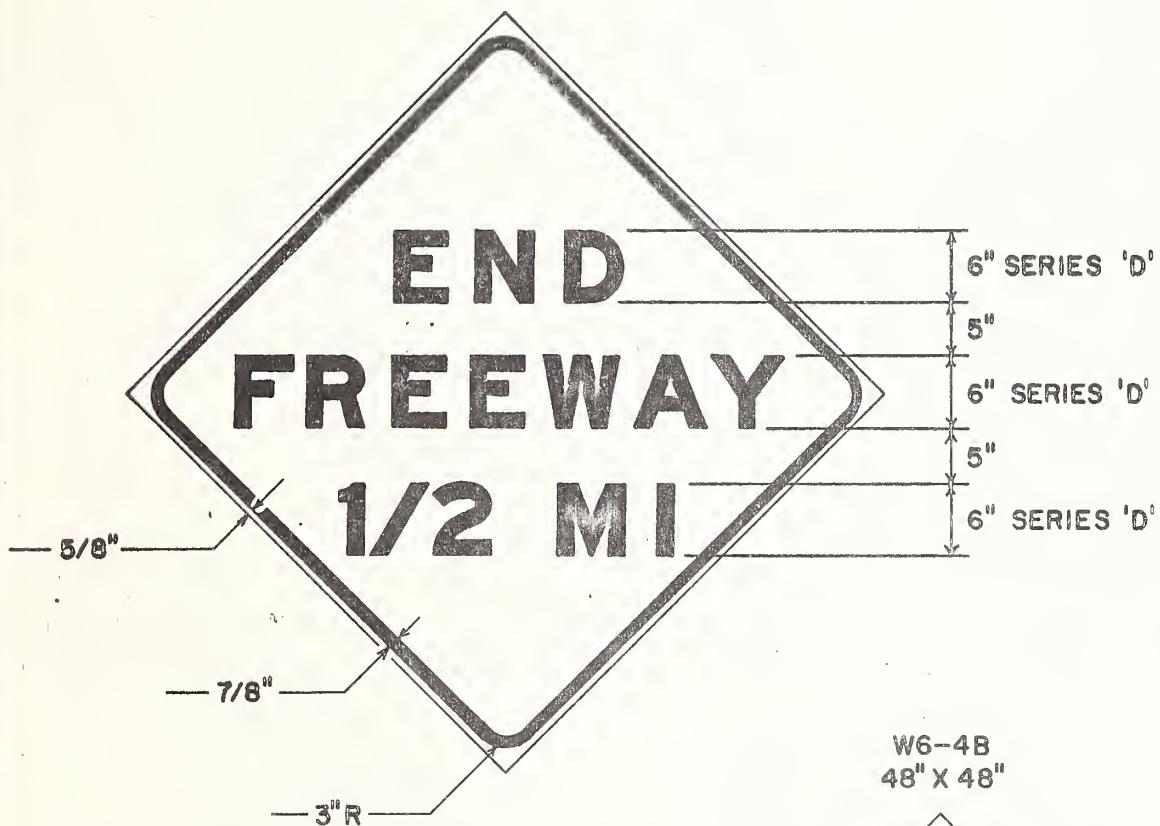
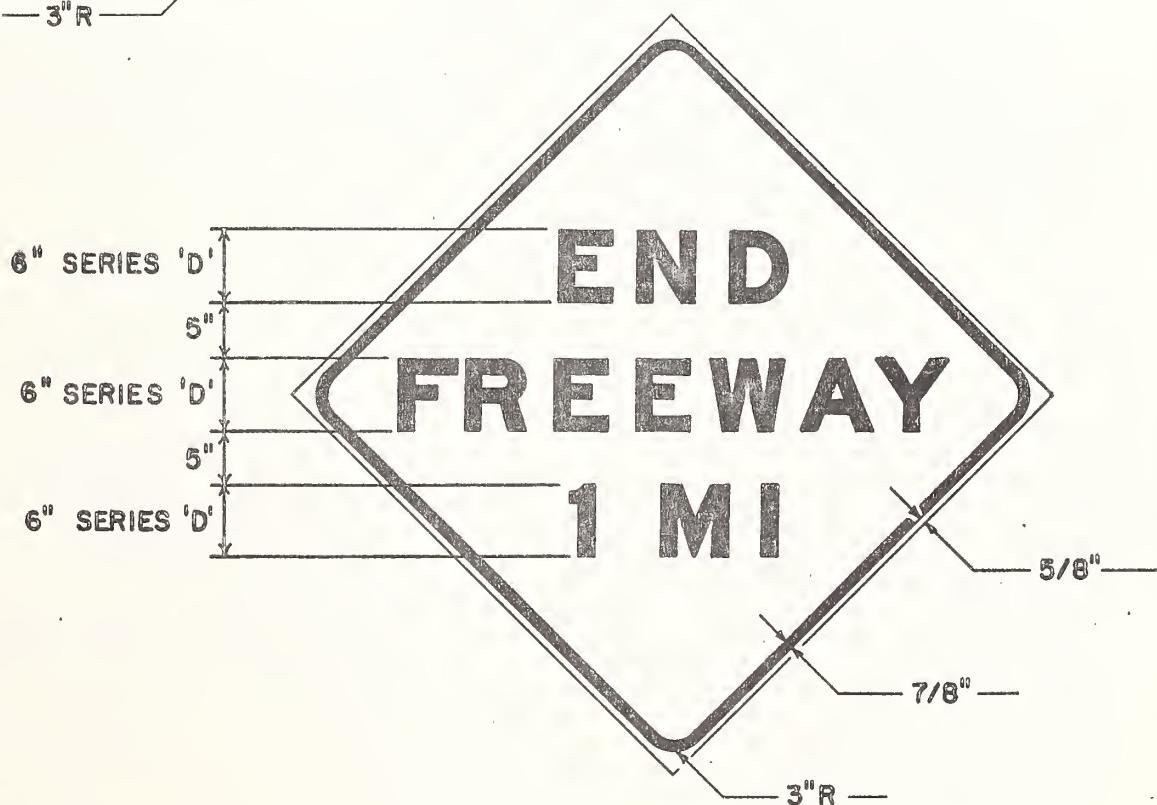
Drawn 6-19-68

Revised —
Effective 11-1-68

STANDARD DRAWING NO. 88-18

State Highway Commission
Helena, Montana

W6-4A & W6-4B

Approved
John M. Johnson, P.E., A.C.P.
State Highway EngineerW6-4A
48" X 48"W6-4B
48" X 48"

Drawn 3-1-66

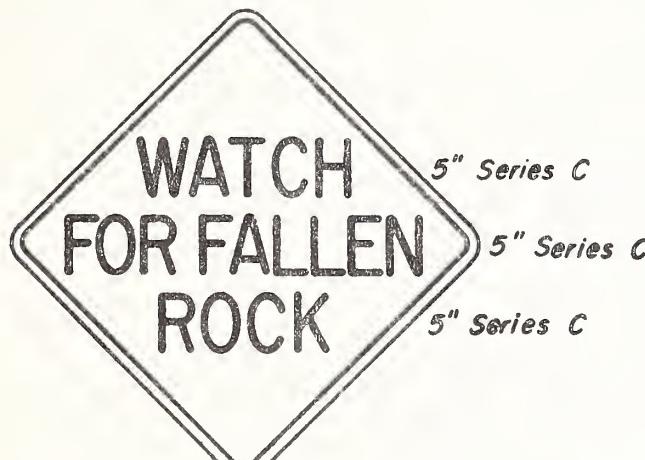
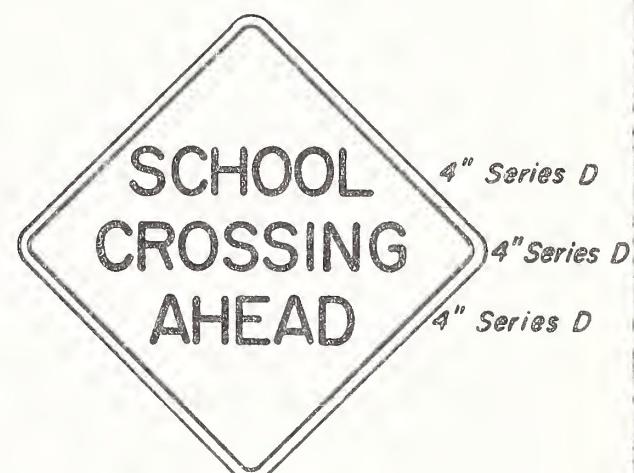
REVISED
EFFECTIVE 3-1-66

STANDARD DRAWING NO.

88 - 19

State Highway Commission
Helena, Montana

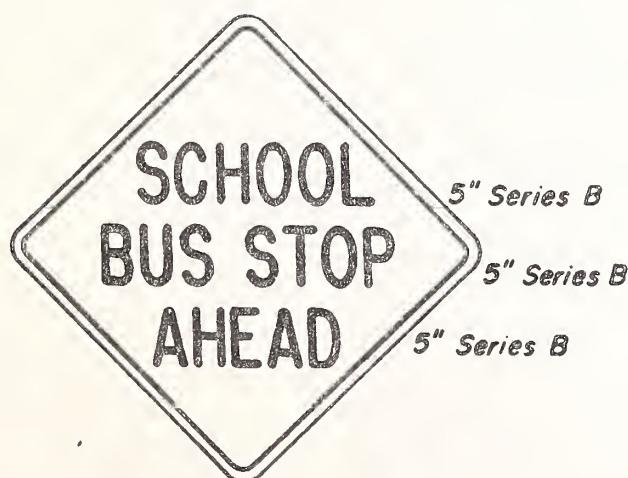
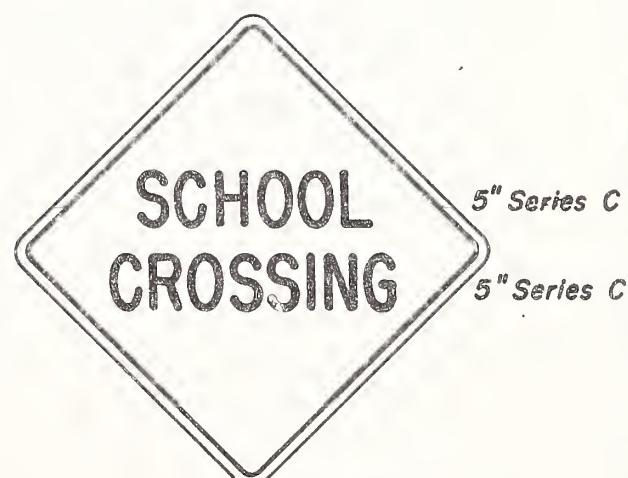
W8-9, W9-2, W9-5, & W9-6 WARNING SIGNS

Approved
F. J. [Signature]
State Highway EngineerW8-9
30 X 30W9-5
30 X 30**NOTE**

Warning sign W8-9 shall have black legend and borders on a reflectorized yellow background. The Bureau of Public Roads "STANDARD ALPHABET" shall be used.

NOTE

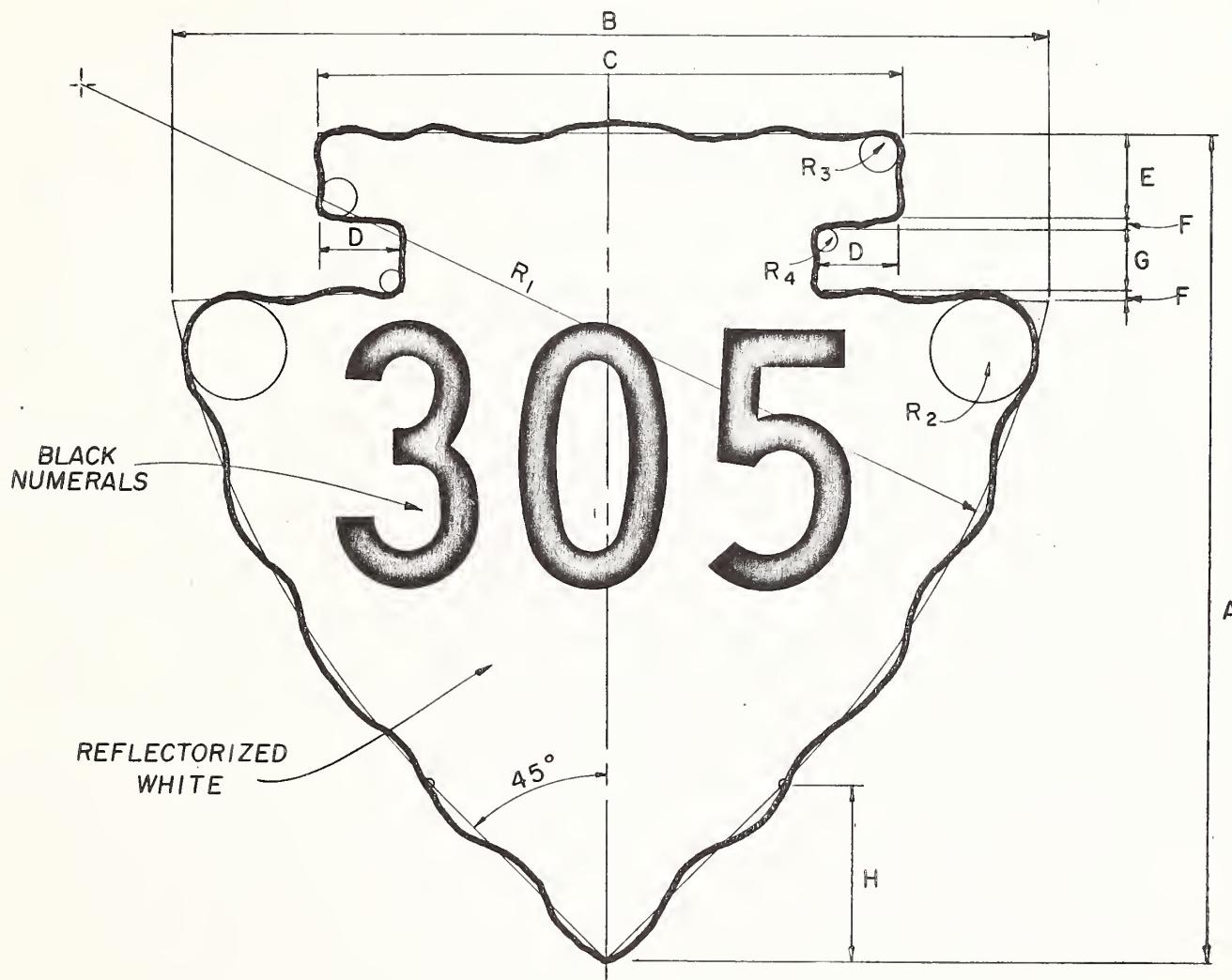
Warning signs W9-2, W9-5, & W9-6 shall have black legend and borders on a yellow background. The Bureau of Public Roads "STANDARD ALPHABET" shall be used.

W9-6
30 X 30W9-2
30 X 30

Drawn 9-1-64

Revised 3-1-67
Effective 6-1-67

STANDARD DRAWING NO. 88-28

State Highway Commission
Helena, MontanaSECONDARY ROUTE MARKER
FOR USE ON GUIDE SIGNSApproved
Lewis M. Shettler
Act. State Highway Engineer

SHIELD DIMENSIONS IN INCHES

NUMERAL SIZE	A	B	C	D	E	F	G	H	R ₁	R ₂	R ₃	R ₄	
*	8" C	26	28	18 $\frac{1}{2}$	2 $\frac{5}{8}$	3	$\frac{5}{16}$	2	5 $\frac{1}{2}$	32	1 $\frac{3}{4}$	$\frac{5}{8}$	$\frac{5}{16}$
**	10" C	32	34	22 $\frac{1}{2}$	3 $\frac{1}{4}$	3 $\frac{5}{8}$	$\frac{3}{8}$	2 $\frac{1}{2}$	6 $\frac{3}{4}$	38 $\frac{1}{2}$	2	$\frac{3}{4}$	$\frac{3}{8}$
***	12" C	40	42	28	4	4 $\frac{1}{2}$	$\frac{1}{2}$	3	8 $\frac{7}{16}$	48	2 $\frac{1}{2}$	1	$\frac{1}{2}$

* TO BE USED WITH STANDARD 24" U.S. SHIELD

** TO BE USED WITH STANDARD 30" & 36" U.S. SHIELD

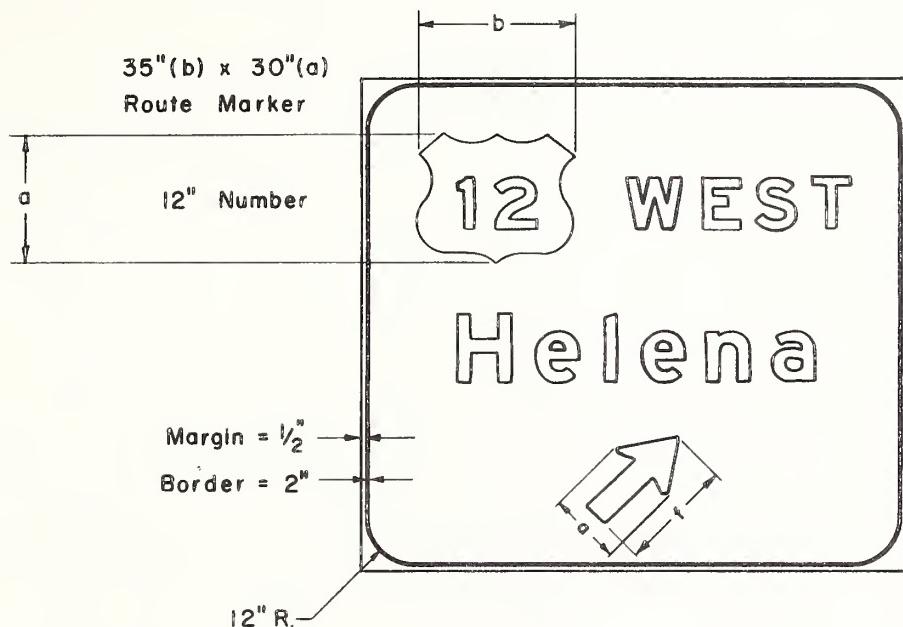
*** TO BE USED WITH STANDARD 42" U.S. SHIELD

Drawn 3-1-66 REVISED
EFFECTIVE 3-1-66

STANDARD DRAWING NO. 88 - 36

State Highway Commission
Helena, Montana

TYPICAL GUIDE SIGN LAYOUT

Approved
State Highway Engineer

Dimensions shown are typical only; see plans for actual sizes

SIGN DESIGN SPECIFICATIONS

Smaller Dimension of Sign	Corner Radius
0'-0" TO 2'-6"	3"
3'-0" TO 4'-6"	6"
5'-0" TO 6'-6"	9"
7'-0" & Greater	12"

Largest Letter on Sign	Margin	Border
8" Letters or Less	$\frac{1}{2}$ "	1"
Greater Than 8"	$\frac{1}{2}$ "	2"

NOTES

1. All Interstate and U.S. Route Markers, and all Arrows used on Guide Signs must conform to those shown in the AASHO "Manual for Signing and Pavement Markings", 1961 Interstate Edition.
2. All State Route Markers must conform to those shown in the M.S.H.C. "Book of Standard Drawings."
3. Guide Signs shall have white legend and border on an Interstate Green background. Legend, border, and background shall be reflectorized. Type A, B, or C removable copy shall be used unless otherwise specified.

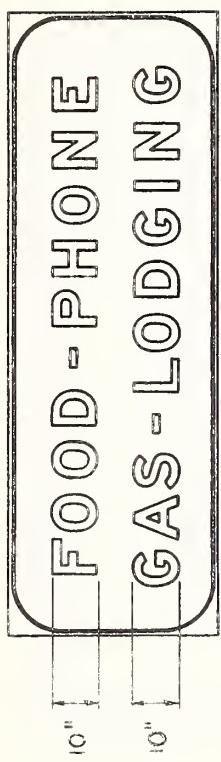
Drawn 3-1-66

REVISED 8-19-68
EFFECTIVE 11-1-68

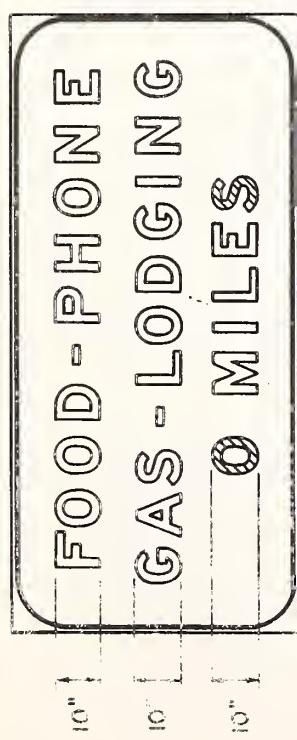
STANDARD DRAWING NO. 88-37

State Highway Commission
Helena, Montana

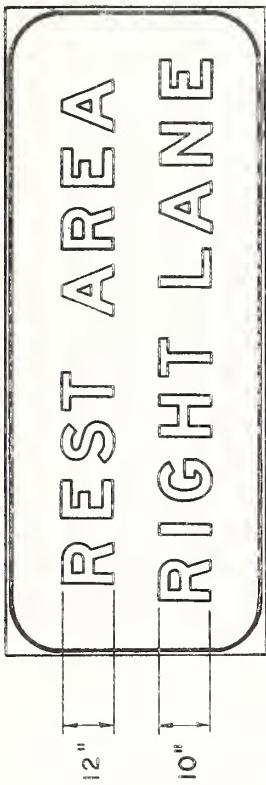
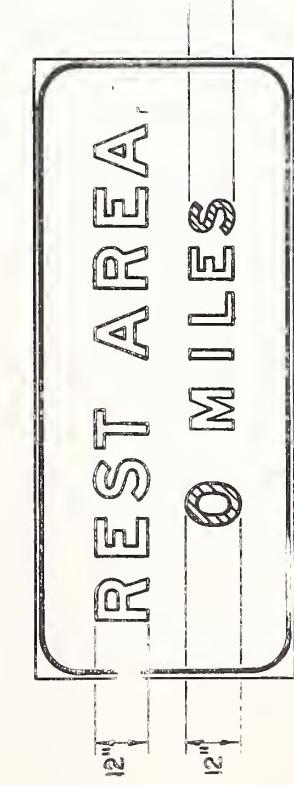
INFORMATIONAL SIGNS

Approved
Louis M. Chittenden
State Highway Engineer

NOTE I-1 & I-2
If any of the above services is not available
the space it normally occupies is to be left blank.
See plan sheet for services to be shown.

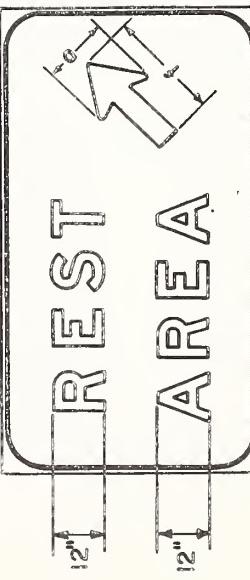


I-3
12'-0" x 5'-0"

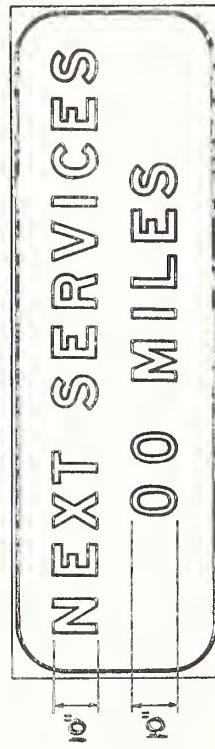


NOTE:

Informational Guide Signs shall have white legend and border on an Interstate Blue background. Legend, border and background shall be reflectorized. Type A, B, or C removable copy shall be used. (See Standard Specifications)



25" (1) x 21 $\frac{7}{8}$ " (a)
Type "B" Arrow at
45° angle.



I-6
13'-0" x 4'-0"

Drawn Oct. 1, 1964

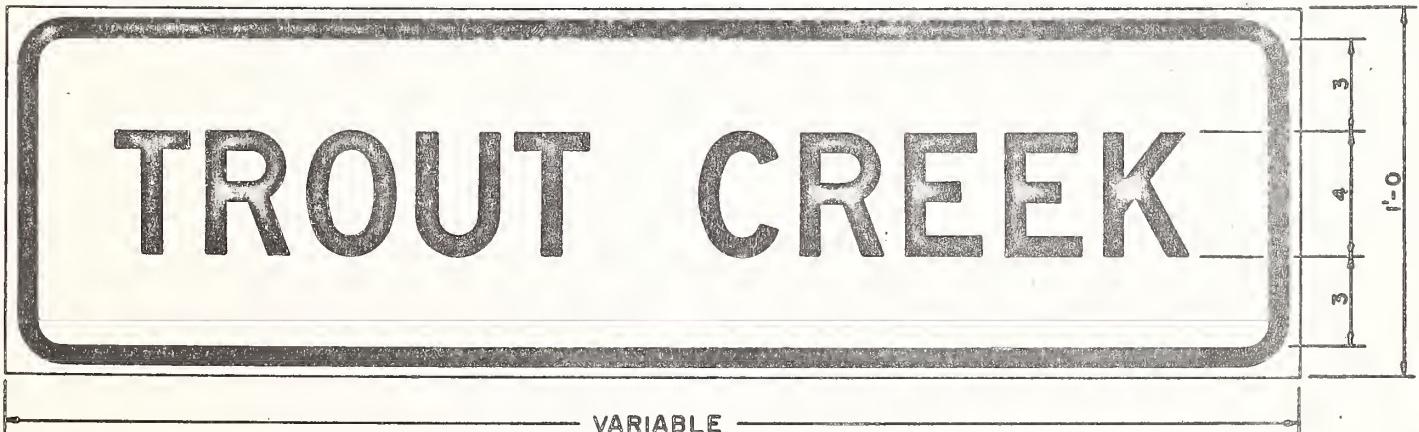
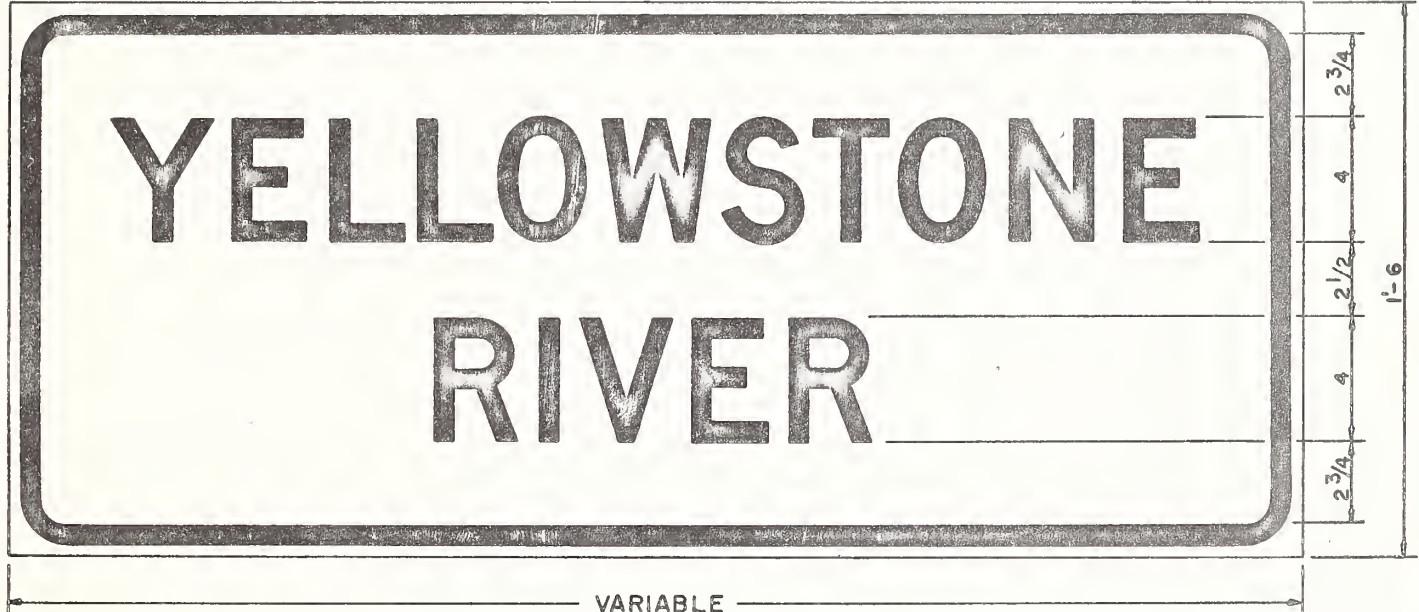
REVISED
EFFECTIVE 10-1-64

STANDARD DRAWING NO. 88-38

State Highway Commission
Helena, Montana

STANDARD N6-2 STREAM NAME SIGN

Approved

Louis J. Pichard
Louis J. Pichard 11-4-64
State Highway Eng'r

NOTES & SPECIFICATIONS:

1. SIGN SIZE VARIES WITH LEGEND.
2. SIGNS OVER 36" WIDE SHALL HAVE 2"x 4"
BACK BRACES.
3. POST SIZE:
 - UP TO 5 SQ.FT. OF SIGN AREA USE 4"x 4"
TREATED TIMBER POST, 3'-6" FOUNDATION.
 - 6 TO 10 SQ.FT. OF SIGN AREA USE 4"x 6"
TREATED TIMBER POST, 4'-0" FOUNDATION.
 - OVER 10 SQ.FT. OF SIGN AREA USE 2 4"x 6"
TREATED TIMBER POSTS, 4'-0" FOUNDATION.

4. MOUNTING:
 - 5'-0" ABOVE SHOULDER TO BOTTOM OF SIGN.
 - 2'-0" FROM SHOULDER TO NEAR SIDE OF SIGN.
5. SIGN FACE & LEGEND:
 - REFLECTORIZED GREEN BACKGROUND.
 - 4" SERIES D REFLECTORIZED WHITE LETTERS.
 - 3/8" MARGIN.
 - 5/8" REFLECTORIZED WHITE BORDER.
 - 1/2" CORNER RADIUS.

Drawn 6-24-68

Revised 6-10-69
Effective 1-1-69

6-10-69

7-1-69

STANDARD DRAWING NO. 88-39

State Highway Commission
Helena, Montana

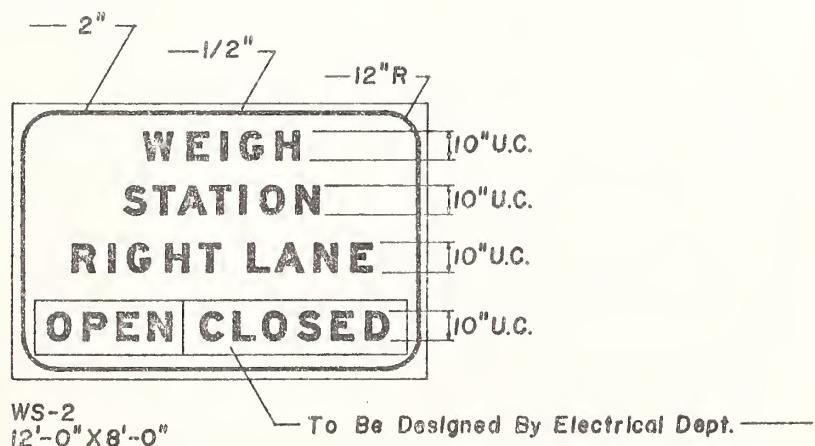
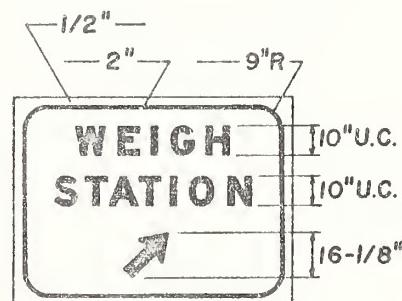
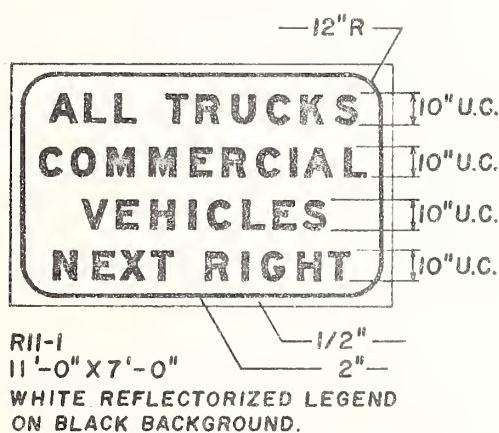
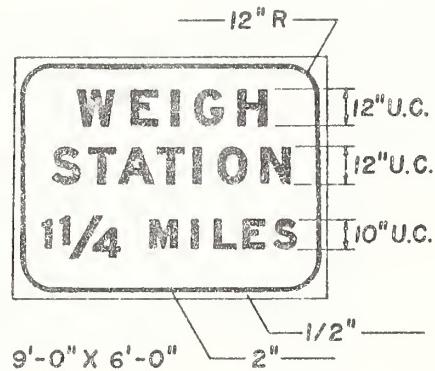
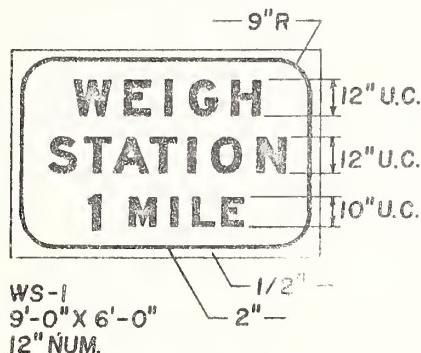
WEIGH STATION SIGNS

Approved

State Highway Engineer

NOTE

WEIGH STATION GUIDE SIGNS SHALL HAVE WHITE LEGEND AND BORDER ON INTERSTATE GREEN BACKGROUND. LEGEND, BORDER, AND BACKGROUND SHALL BE REFLECTORIZED. TYPE A,B REMOVABLE COPY SHALL BE USED. (SEE STANDARD SPECIFICATIONS).



Drawn 9-1-64

Revised 1-1-68
Effective 2-1-68

STANDARD DRAWING NO. 88-47

State Highway Commission
Helena, Montana

STANDARD REST AREA & INFORMATION SIGNS

Approved

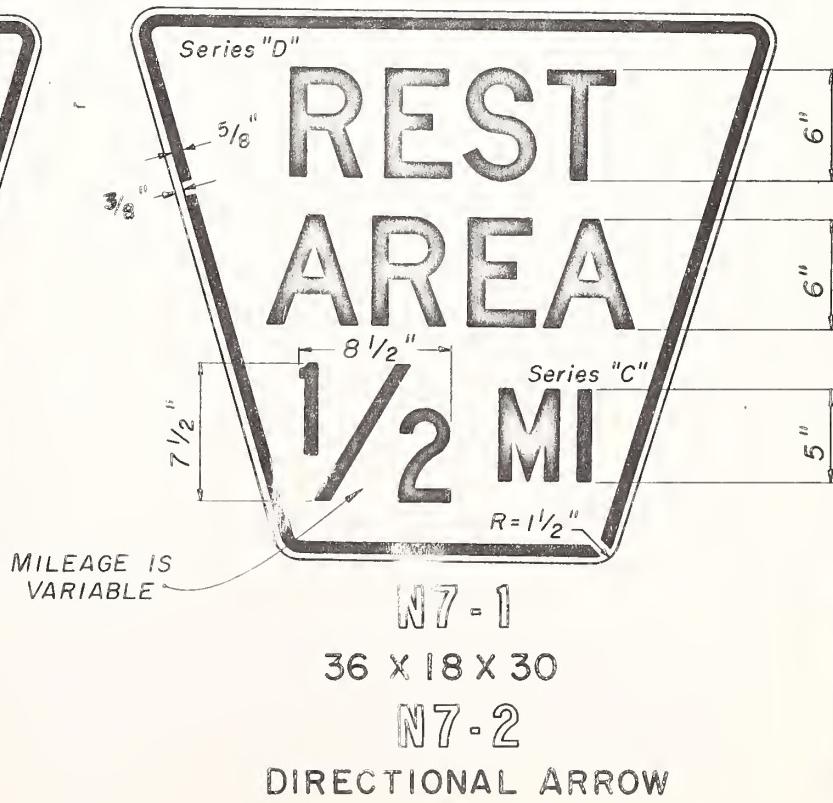
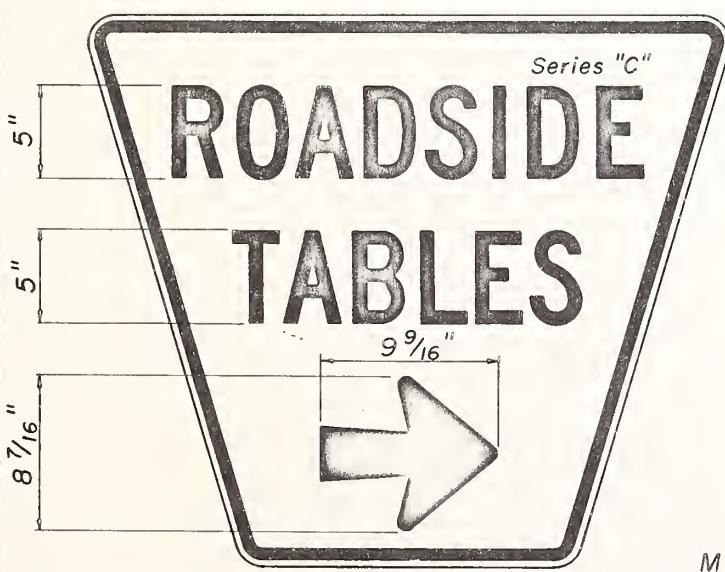
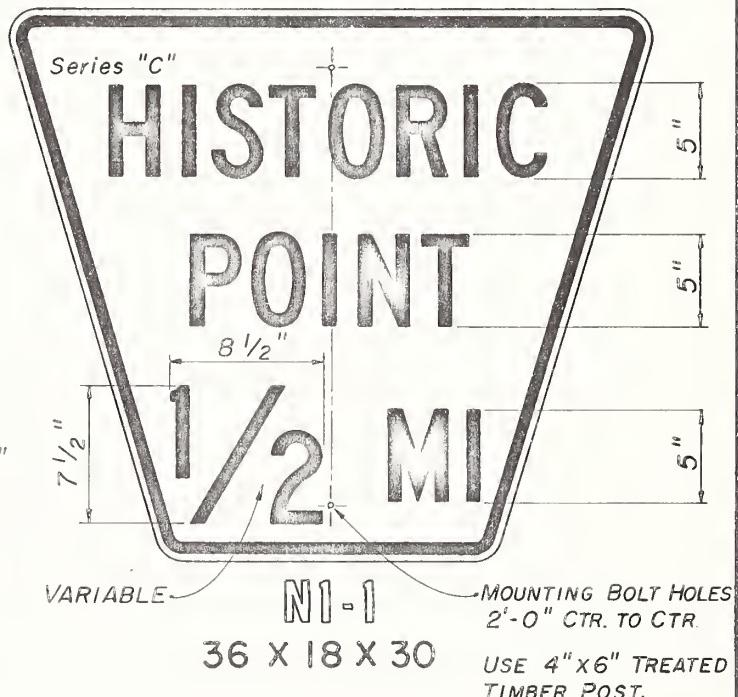
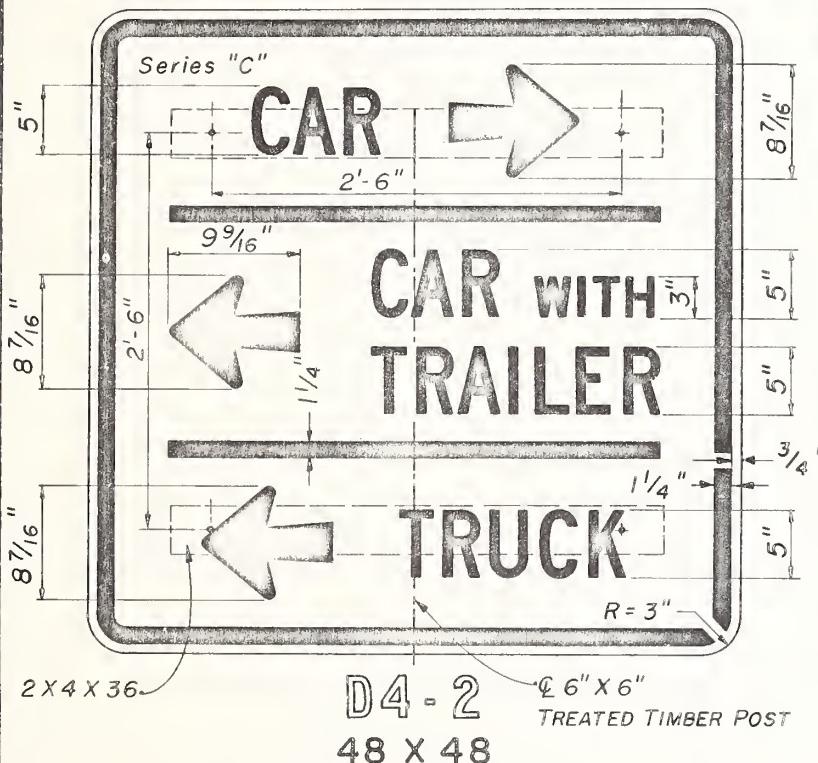
Lewis M. Pritchard 5-67
State Highway Engineer

NOTES:

1. ALL SIGNS ON THIS PAGE SHALL HAVE GREEN LEGEND AND BORDERS ON A WHITE REFLECTORIZED BACKGROUND.
2. ALL DIRECTIONAL ARROWS SHALL BE THE INTER-STATE TYPE "B" ARROW, $9\frac{9}{16}$ " X $8\frac{7}{16}$ ".

3. SEE D4-2 & N7-1 FOR TYPICAL SIGN PANEL DETAILS. (BORDER, MARGIN, ETC.)

4. SIGNS ON THIS PAGE ARE TYPICAL SIGNS. SEE PLAN SHEETS FOR ACTUAL SIGN LAYOUTS.



N3-2
36 X 18 X 30
N3-1
" 1/2 MI"
VARIABLE

N7-1
36 X 18 X 30
N7-2
DIRECTIONAL ARROW

Drawn 6-1-65

Revised 11-1-68
Effective 1-1-69

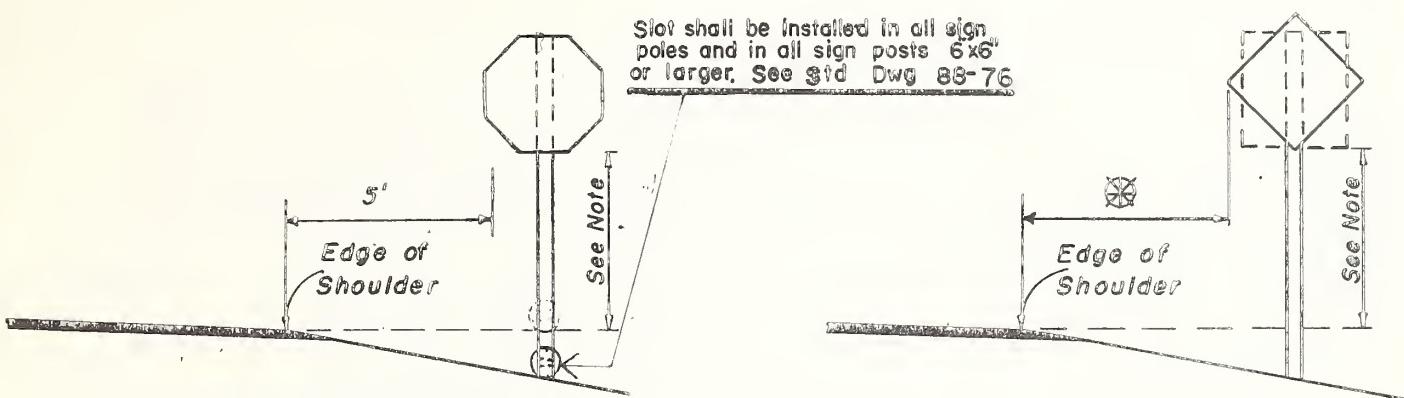
STANDARD DRAWING NO. 88-57

State Highway Commission
Helena, Montana

TYPICAL SIGN ERECTION

Approved
James M. Orlitzke (S.E.)
State Highway Engineer

FOR REGULATORY & WARNING SIGNS



FOR ALL STOP SIGNS

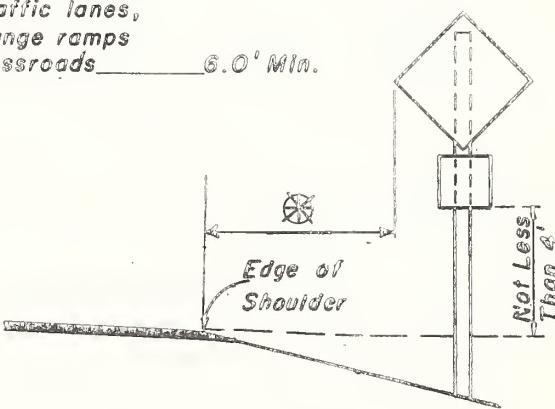
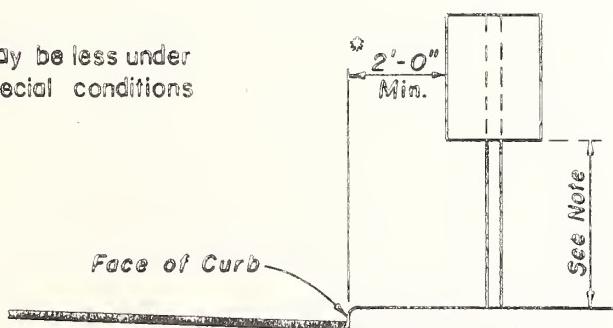
NOTE + MOUNTING HEIGHTS

Rural 5.0' Min.

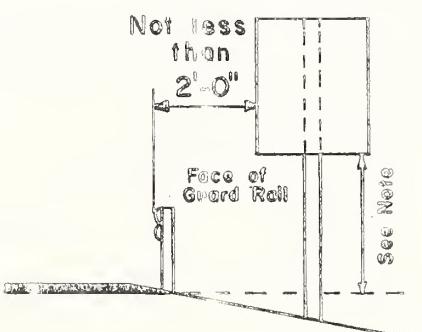
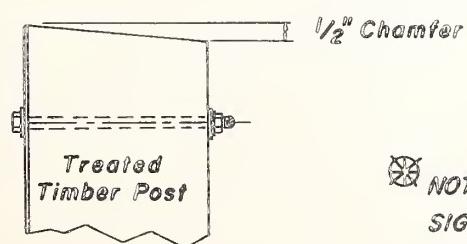
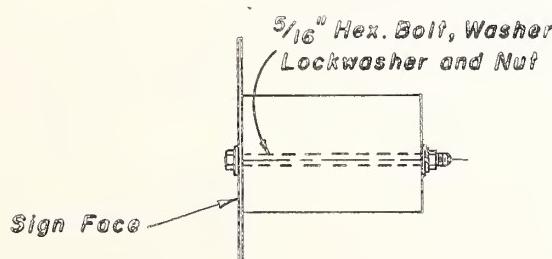
Urban 7.0' Min.

Roads with Four or more traffic lanes, Interchange ramps and Crossroads 6.0' Min.

* May be less under special conditions



FOR CURBED SECTION



FOR GUARD RAIL SECTION

NOTE:

SIGNS LESS THAN 10 SQ. FT. SHALL BE MOUNTED 10' FROM SHOULDER EDGE.

SIGNS GREATER THAN 10 SQ.FT. SHALL BE MOUNTED 20' FROM SHOULDER EDGE.

SIGN FASTENING DETAILS

DRAWN 3-1-67 Revised H-68 11-28-69
EFFECTIVE 6-1-67 Effective 2-1-68 1-1-70

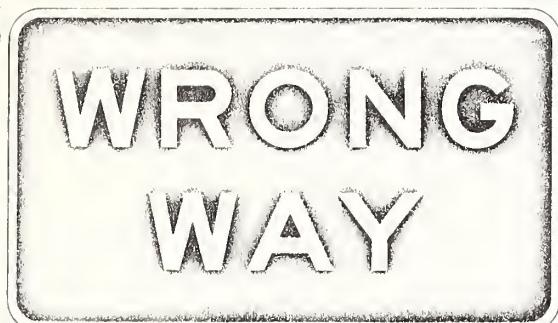
STANDARD DRAWING NO. 88-58

State Highway Commission
Helena, Montana

TYPICAL CROSSROAD & RAMP LAYOUT

Approved
Lewin of Chittenden 67
State Highway Engineer

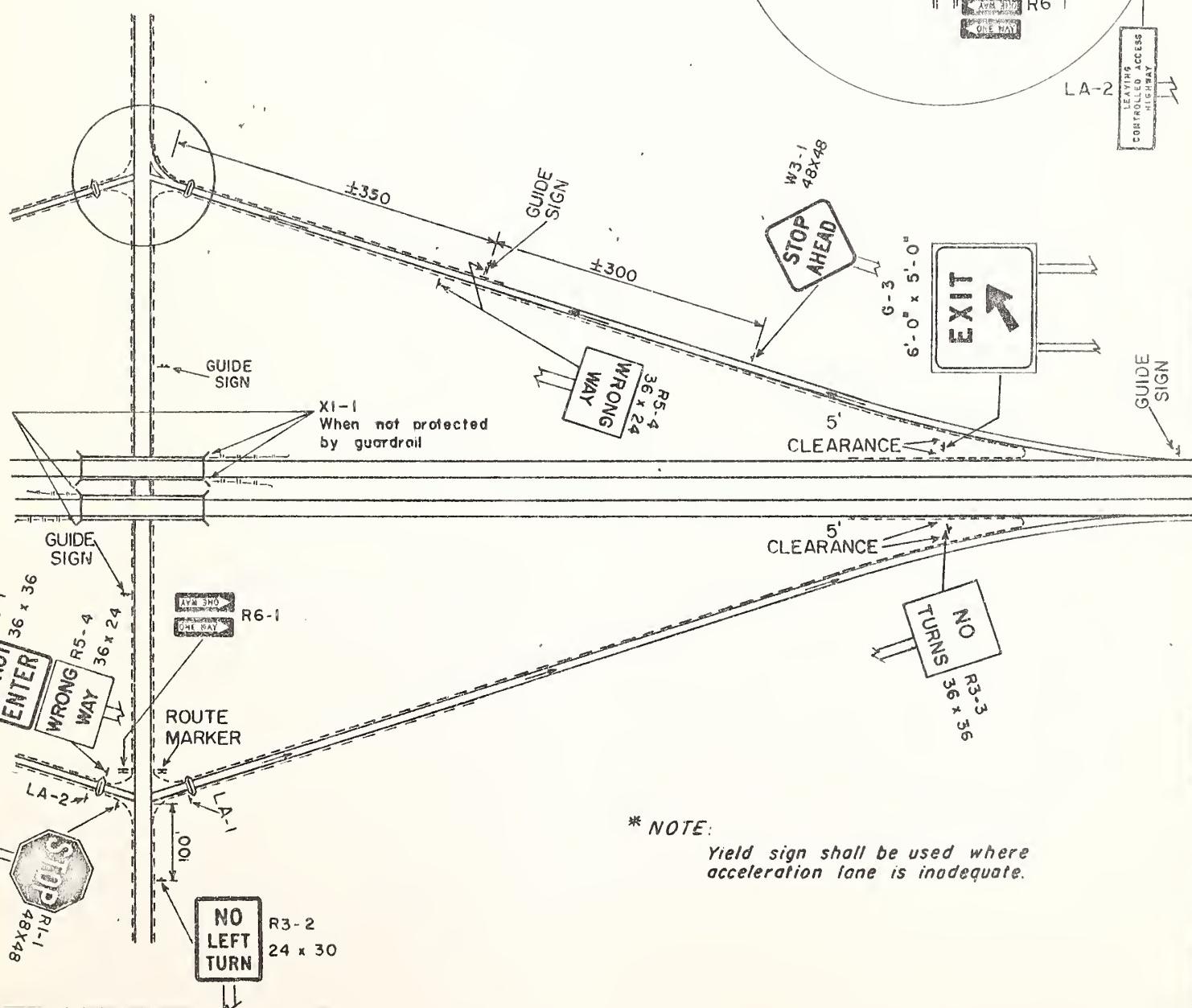
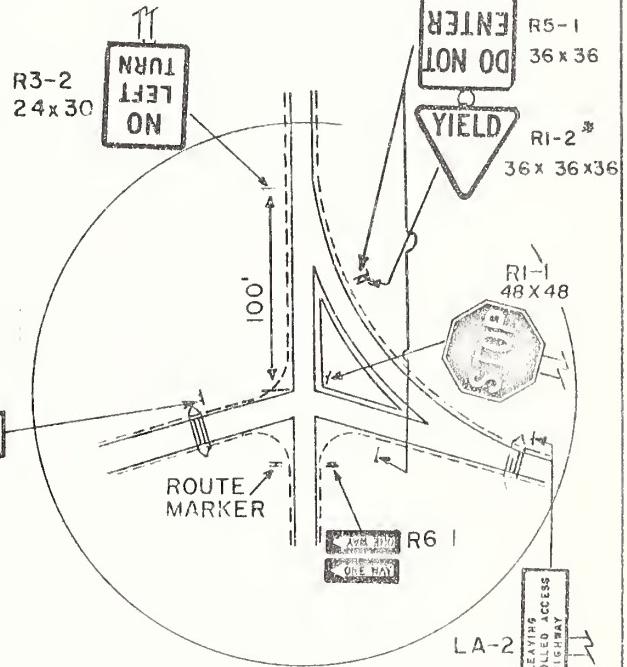
R5-4
36" x 24"



5" Margin
2" Corner Radius

White legend on red reflectorized background

5"
5" Series F
4"
5" Series F
5"



* NOTE:

Yield sign shall be used where acceleration lane is inadequate.

DRAWN 3-1-67 Revised 11-1-68
EFFECTIVE 6-1-67 Effective 1-1-69

STANDARD DRAWING NO. 88-66

State Highway Commission
Helena, Montana

STANDARD GUIDE SIGNS

Approved
John A. Blodgett, P.E.
State Highway Engineer

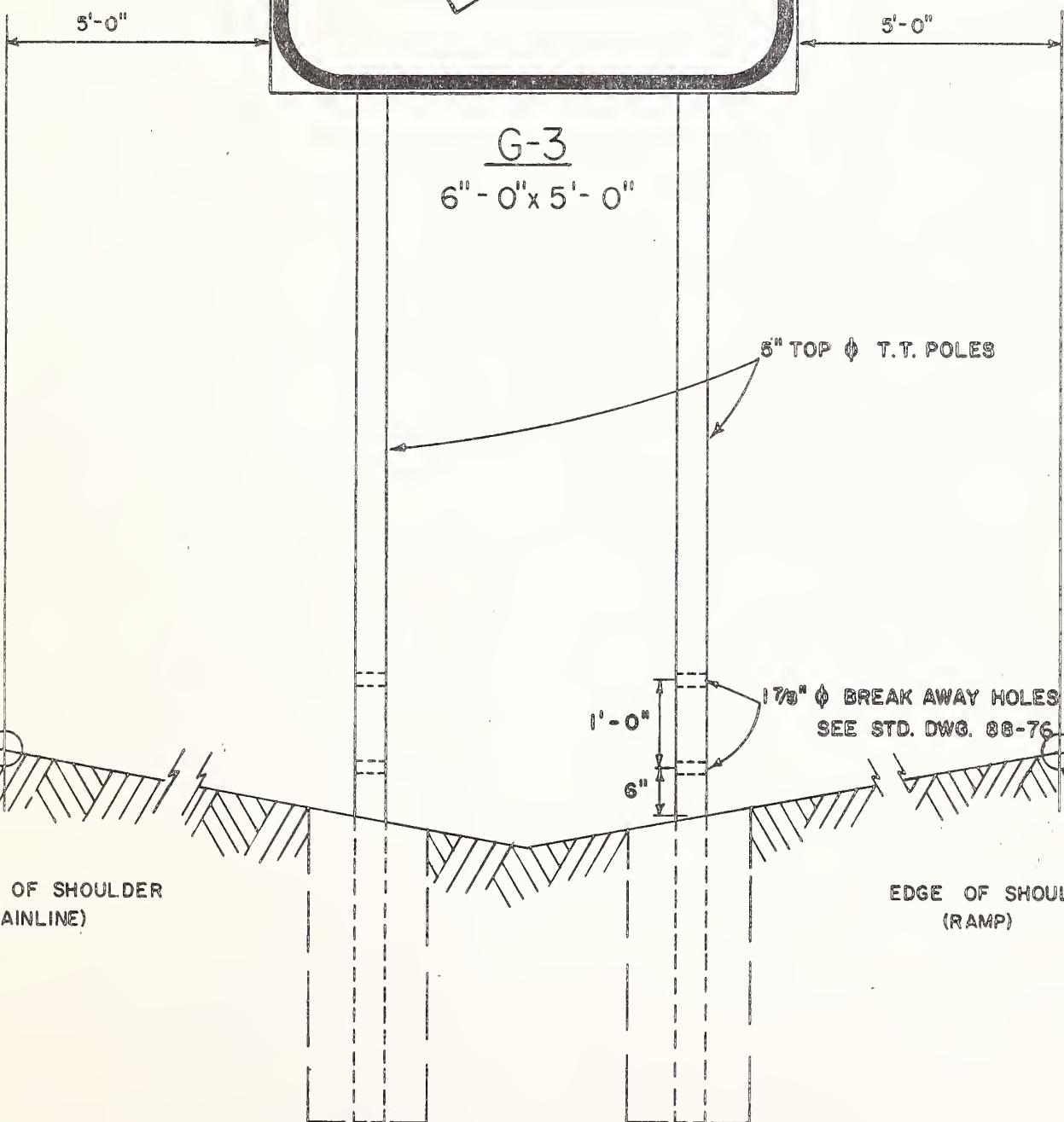


NOTE -

FOR DESIGN SPECIFICATIONS
SEE STANDARD DRAWING
NO. 88-36

12" U.C.
SERIES E.

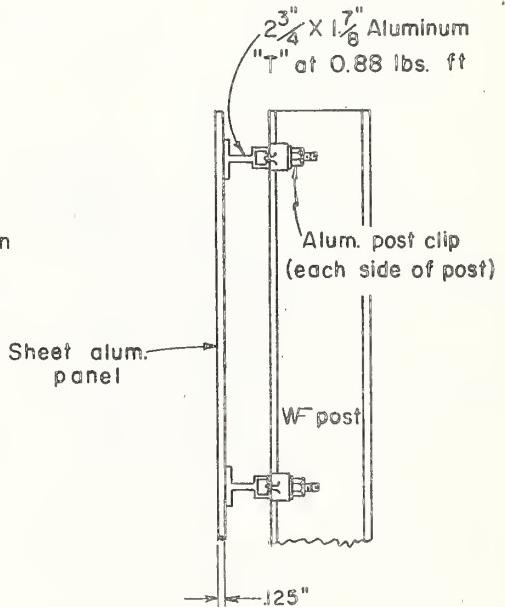
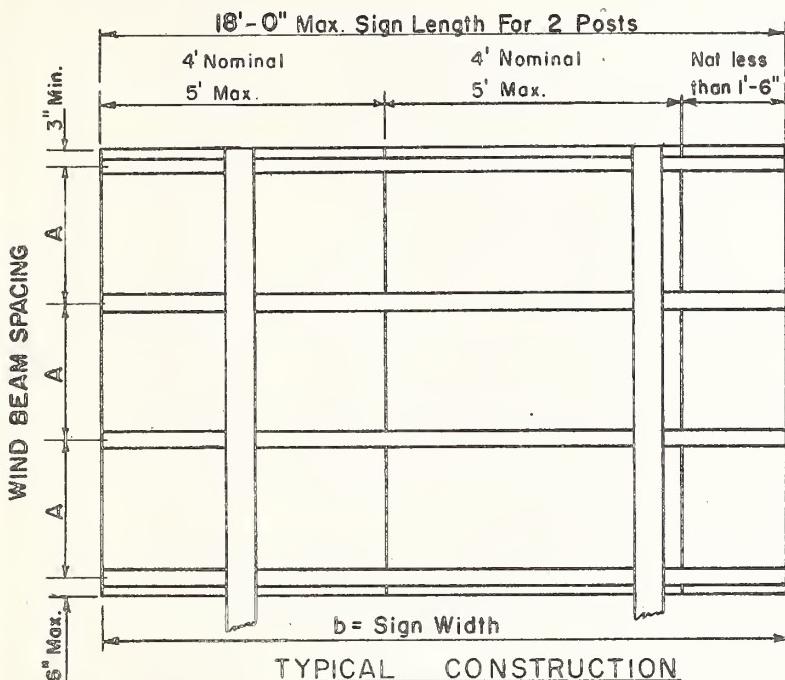
TYPE 'A' ARROW
29 $\frac{1}{4}$ " x 18 $\frac{1}{4}$ "
at 30° ANGLE



Drawn 6-1-65

Revised 3-1-67
Effective 6-1-67

STANDARD DRAWING NO. 88-68

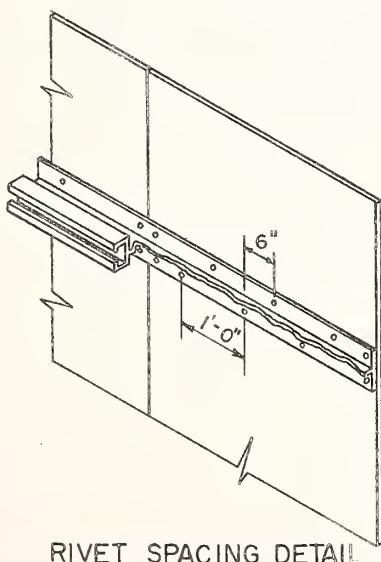
State Highway Commission
Helena, MontanaALUMINUM SHEET INCREMENT
GUIDE SIGNSApproved
Lester P. Schellin
State Highway EngineerNOTE:

Signs less than 4'-0" high and 8'-0" long will be made of a single sheet of aluminum.

Signs up to 8'-0" high will have no horizontal joints and no sheet shall be less than 1'-6" wide.

Signs over 8'-0" high may have horizontal and vertical joints, however no sheet shall be less than 1'-6" wide or 1'-6" high.

Tighten post clip nuts to $225\frac{1}{2}$ in/lbs torque using dry, clean threads.

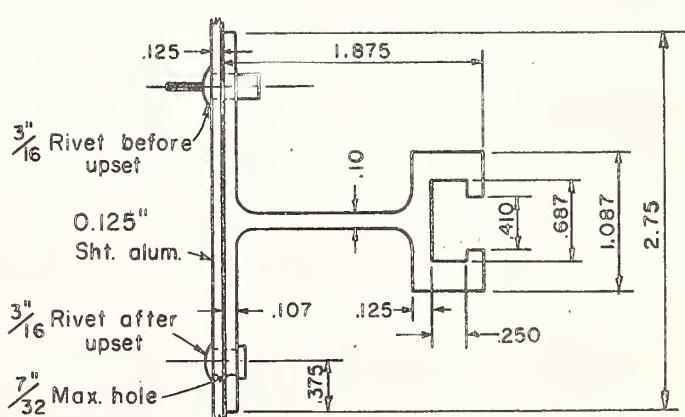


No splices are allowed in extruded "T" sections.

All horizontal joints must occur at "T" sections.

All sheet aluminum shall be 0.125 thick.

Short width panels shall be placed on inside edge next to shoulder.

NOTE:

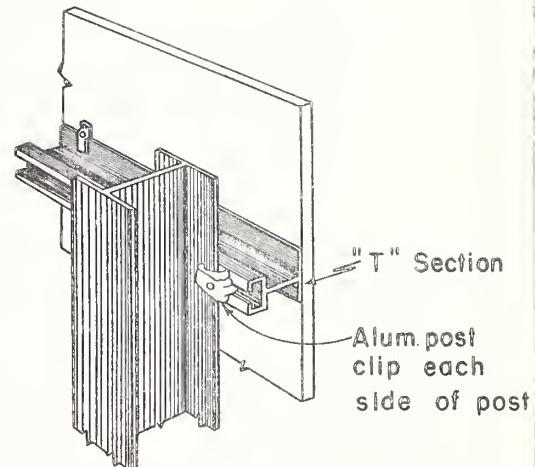
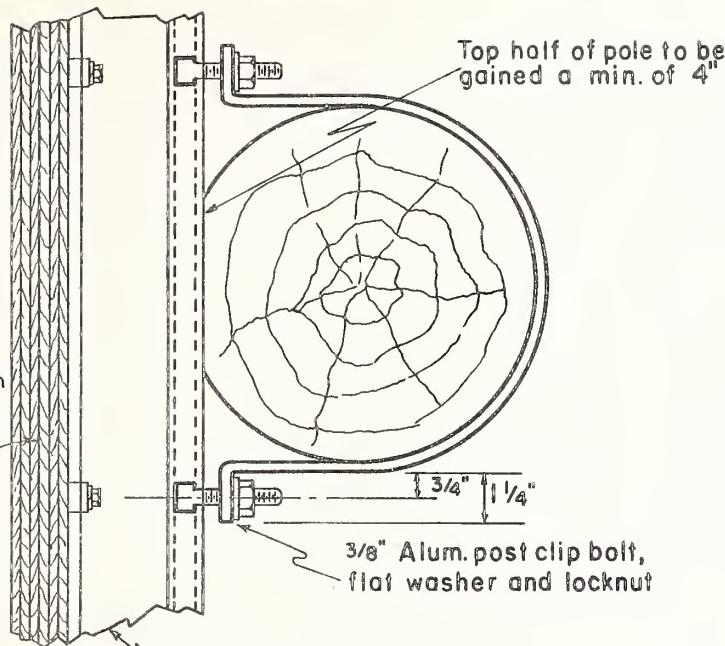
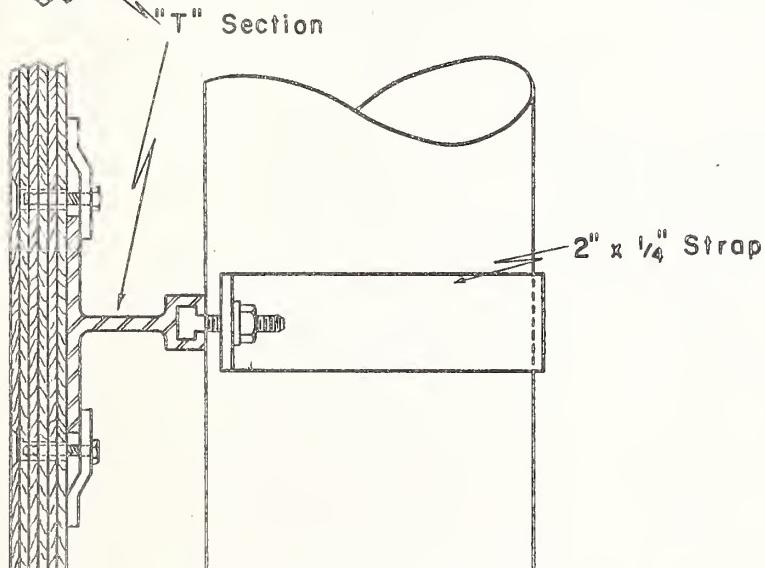
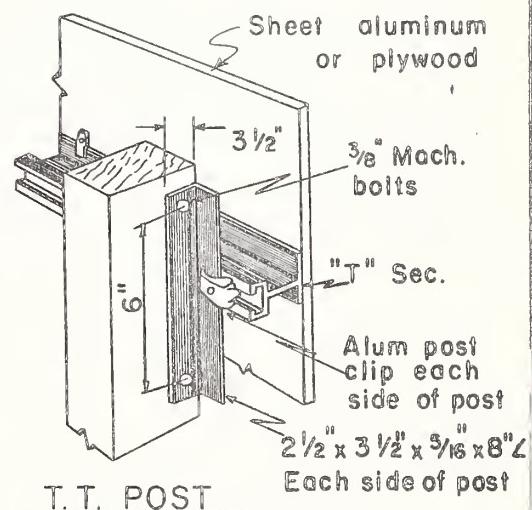
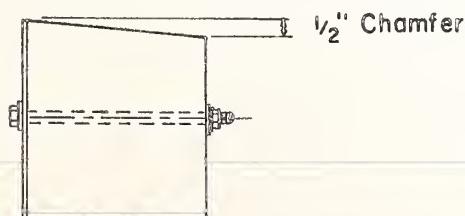
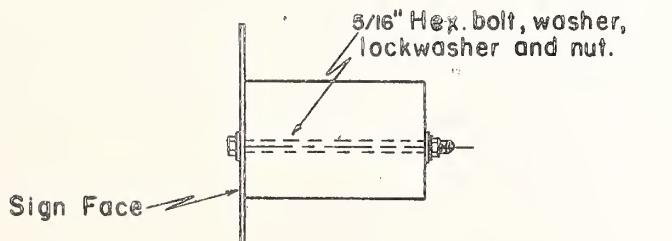
Rivets 6" apart staggered from one side to another on horizontal extruded frame section.

Rivets doubled (both sides of extruded frame) at horizontal and vertical joints in sheet aluminum face and at ends of extruded T-section.

WIND BEAM SPA. "A"	WIND BEAM CHART					
	b MAX.		.20b MAX.	.15b MAX.	.60b MAX.	.35b MAX.
	2 POST	3 POST	2 POST	3 POST	2 POST	3 POST
1-8	18-0	27-0	3-7	4-1	10-10	9-5
1-10	17-0	25-8	3-5	3-10	10-2	9-0
2-0 MAX.	16-6	24-6	3-4	3-8	9-10	8-7

State Highway Commission
Helena, Montana

GUIDE SIGN MOUNTING DETAILS

Approved
Lewis M. Shultz
State Highway EngineerWF POSTT.T. POLET.T. POSTT.T. POSTNOTE:

1. Mounting systems shown are typical. Other systems may be approved by the engineer.
2. All steel hardware shall be galvanized.



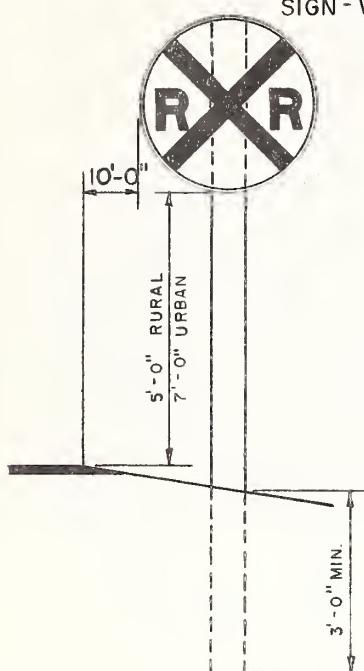
Drawn 1-1-56

Revised 11-1-68
Effective 1-1-69

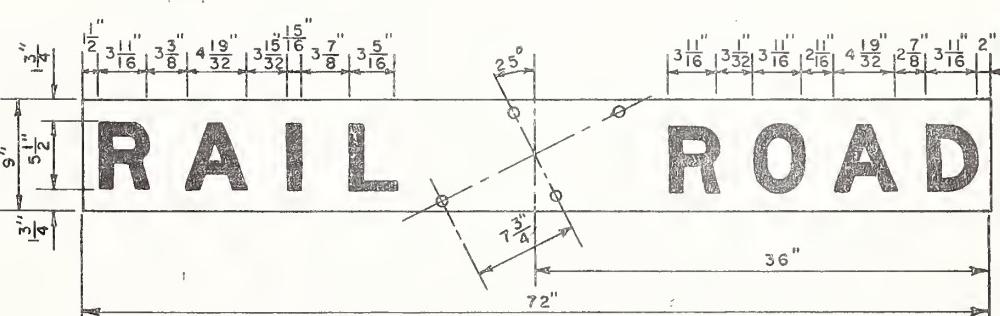
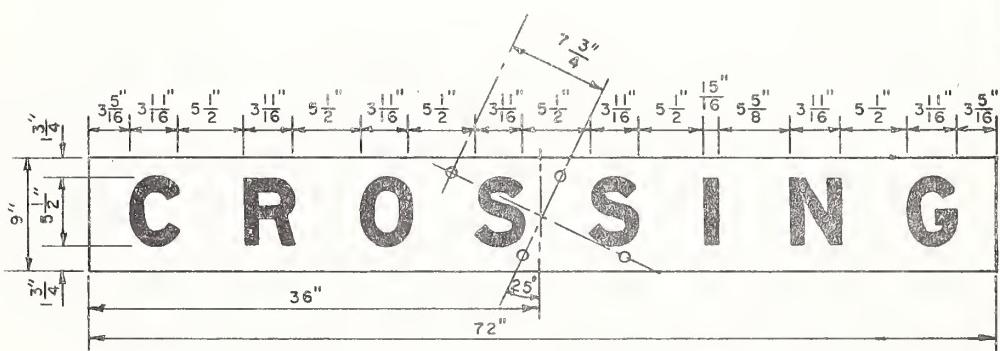
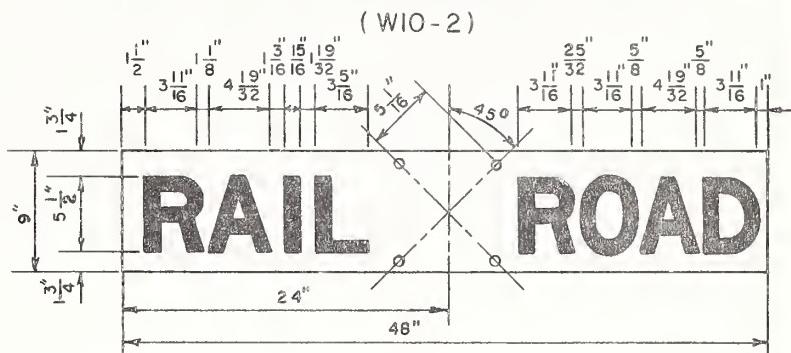
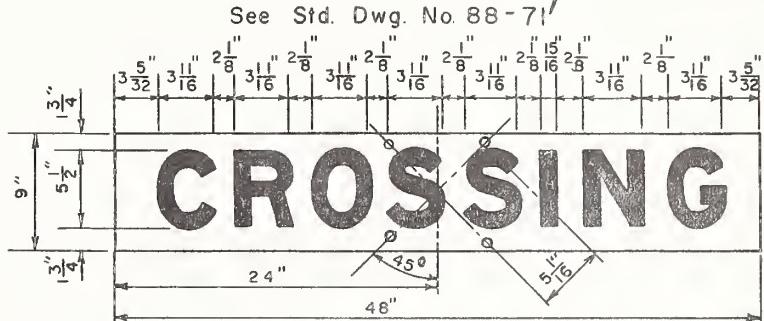
STANDARD DRAWING NO. 88-72

State Highway Commission
Helena, Montana

RAILROAD CROSSING SIGNS

Approved
Louis M. Gifford
State Highway EngineerADVANCE WARNING
SIGN - WIO-1

See Std. Dwg. No. 88-71

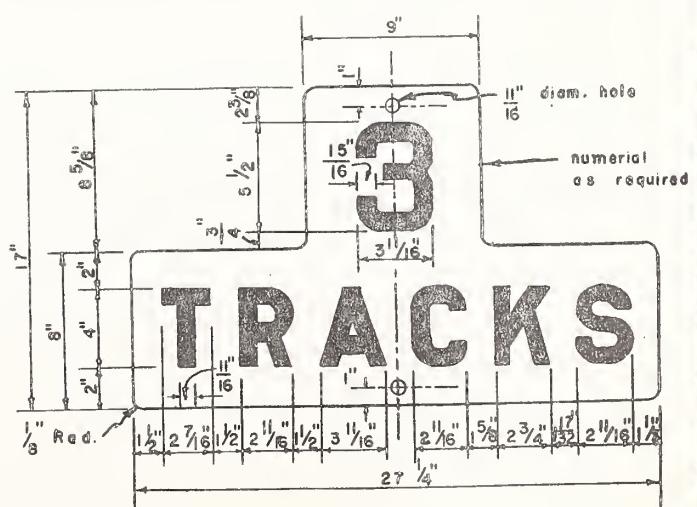


The Advance Warning Signs shall be the standard WIO-1 36" diameter sign shown in the Manual on Uniform Traffic Control Devices for Streets and Highways. It shall have black legend on a reflectorized yellow background. The sign shall be constructed of 6061-T6 aluminum sheet, 0.100 inch minimum thickness. Fabrication shall conform with the Standard Specifications.

The WIO-1 sign shall be erected with a 10 ft horizontal clearance from the edge of the shoulder or face of the curb. The mounting height to the bottom of the sign shall be 5 ft. in rural areas and 7 ft. in urban areas.

In rural areas a treated timber pole or post (break-away design) shall be used. See Std. Dwg. 88-76 in urban areas a 2½" diameter pipe post using the breakaway device as shown on sign standard No. 10.

Bolts shall be $\frac{5}{16}$ " aluminum, galvanized steel or cadmium plated steel, lengths as required.





Drawn 3-1-63

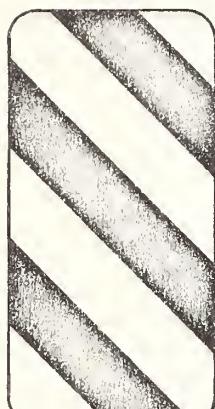
REVISED 3-1-66 11-28-69
EFFECTIVE 3-1-66 1-1-70

STANDARD DRAWING NO. 88-74

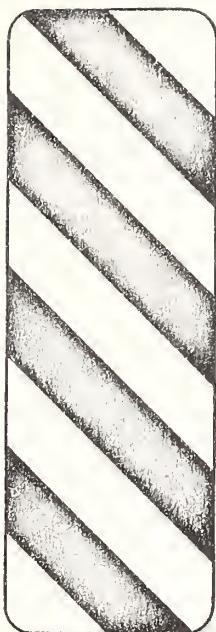
State Highway Commission
Helena, Montana

X1-1 SIGN & ERECTION DETAIL

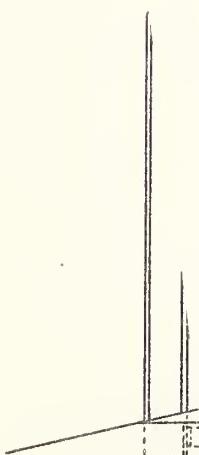
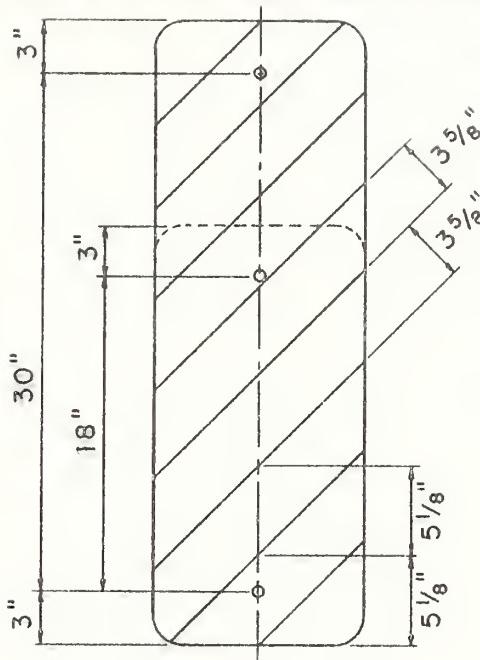
Approved

James M. Butler 11-28-69
State Highway Engineer

12" X 24"



12" X 36"





DRAWN 3-1-67 Revised 11-1-68
EFFECTIVE 6-1-67 Effective 1-1-69

STANDARD DRAWING NO. 88-75

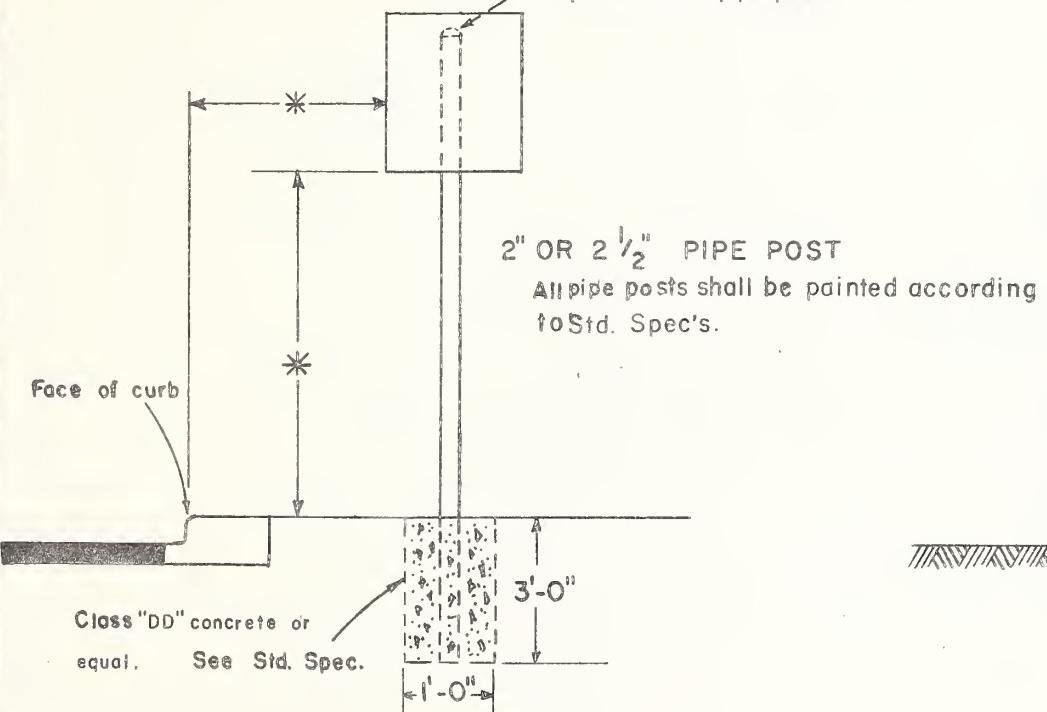
State Highway Commission
Helena, Montana

TYPICAL PIPE POST MOUNTING DETAIL

Approved
Lewo of Chittenden 1-15-67
State Highway Engineer

* For Erection Details see
Std. Drawing 88-57

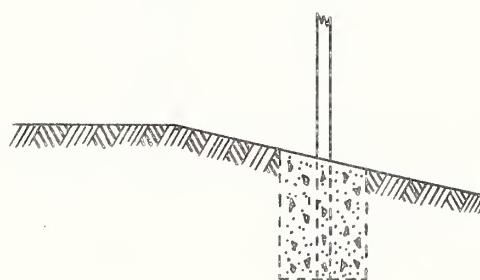
A Suitable water-tight cap to be
placed on all pipe posts.



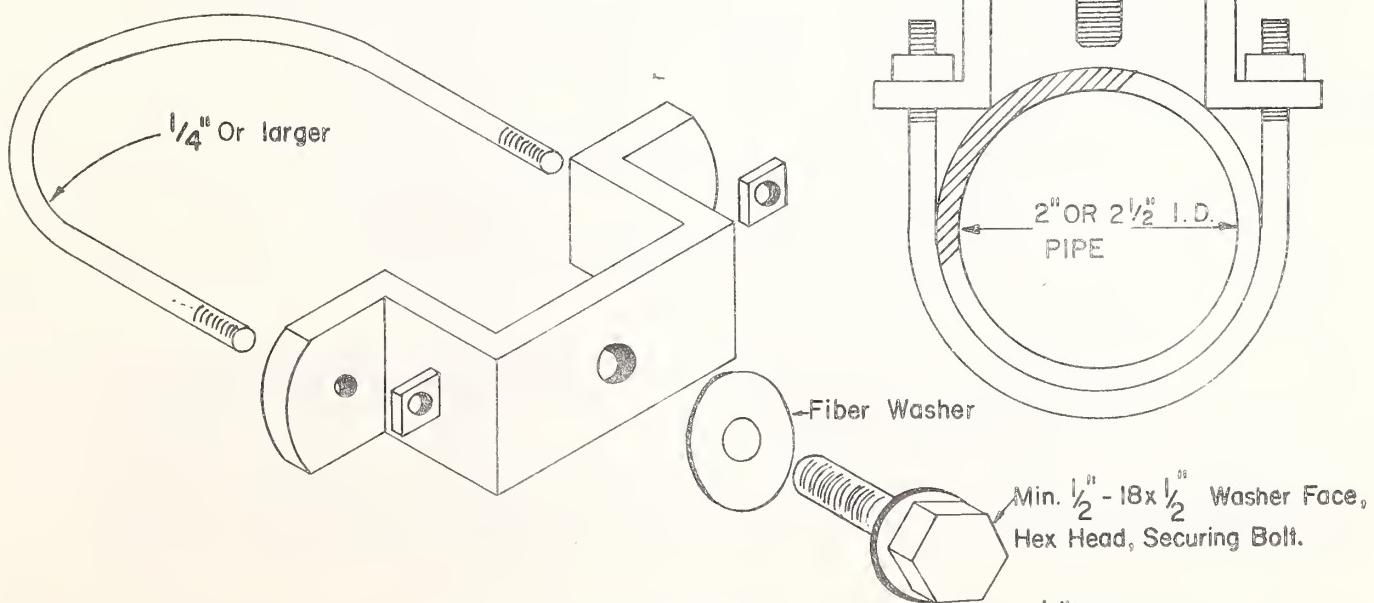
CURB MOUNTING

NOTE: For back to back sign installation, two "U" brackets will be required using two-
 $2\frac{1}{2}'' \times \frac{1}{4}''$ carriage bolts in place of "U" bolt.

All hardware shall be cadmium plated or
galvanized.



SLOPE MOUNTING



TYPICAL "U" BRACKET FOR 2" OR 2 1/2" PIPE POST



Drawn 3-1-68

Revised 11-1-68
Effective 1-1-69

STANDARD DRAWING NO. 88-76

State Highway Commission
Helena, Montana

WOOD POLE SLOT DETAIL

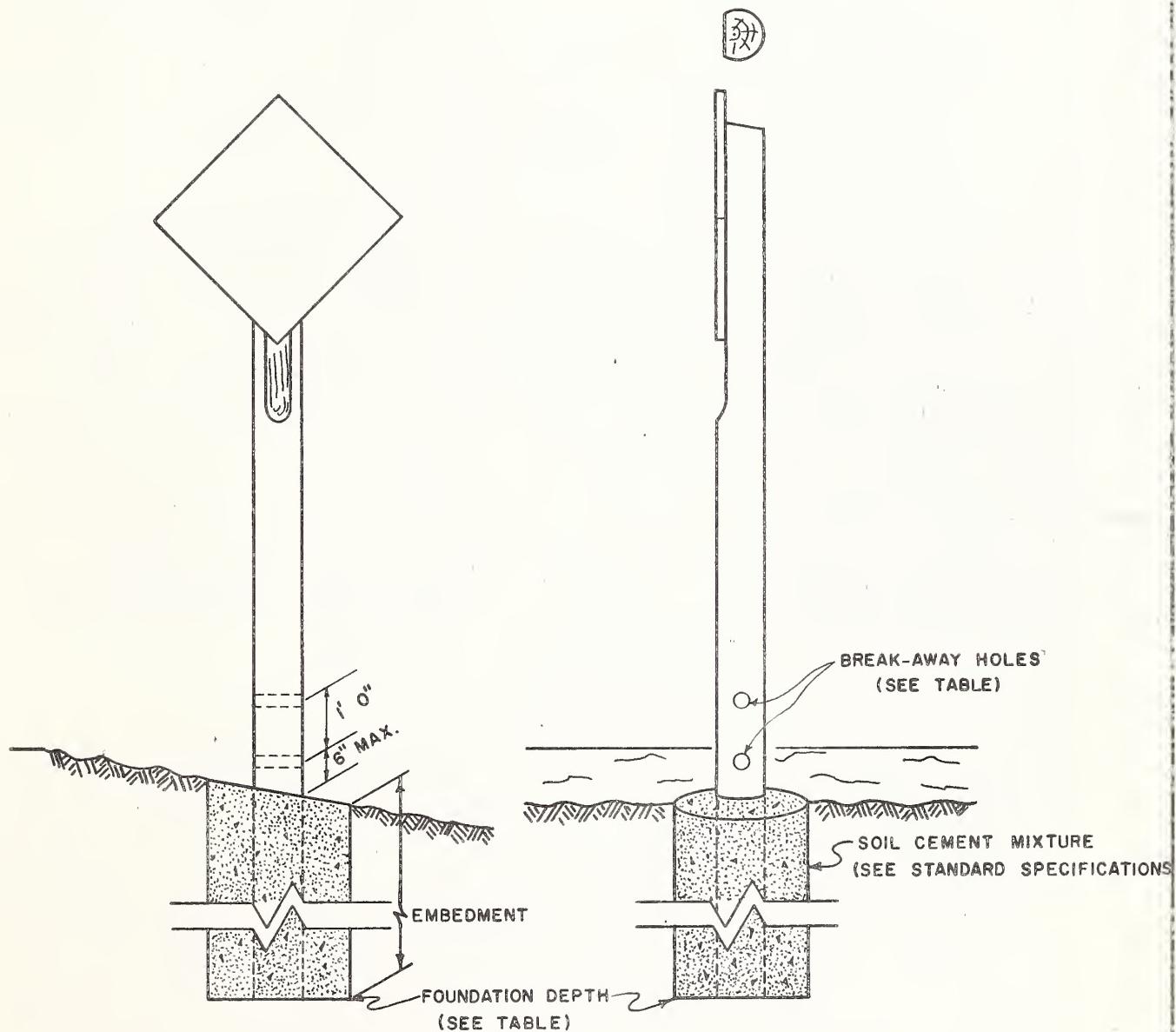
Approved.
Lewis M. Shullin
State Highway EngineerSTANDARD BREAK AWAY DETAIL
SINGLE OR MULTIPLE ROUND TIMBER POLES

TABLE OF DIAMETERS & FOUNDATIONS		
POLE SIZE	HOLE DIA.	EMBEDMENT
4" TOP Ø	1-1/2"	3'-0"
5" TOP Ø	1-7/8"	3'-0"
6" TOP Ø	2-1/8"	3'-6"
CLASS 4	2-1/2"	4'-0"
CLASS 3	2-5/8"	4'-0"

NOTES:

ALL CUTTING, TRIMMING AND BORING
OF TREATED TIMBER POLES SHALL BE
IN ACCORDANCE WITH STANDARD SPECIFICATIONS.

TREATED TIMBER POSTS, 4"X 4" OR 4"X 6"
WILL NOT REQUIRE HOLES FOR BREAKAWAY DESIGN.

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Drawn 3-1-66

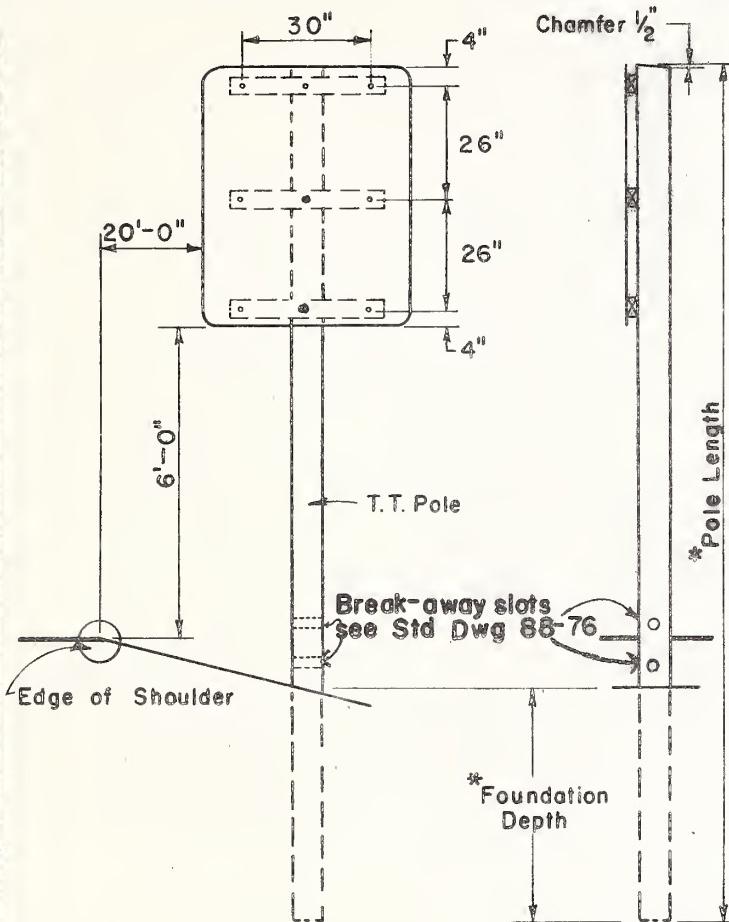
Revised	11-1-68
Effective	1-1-69

STANDARD DRAWING NO. 88-77

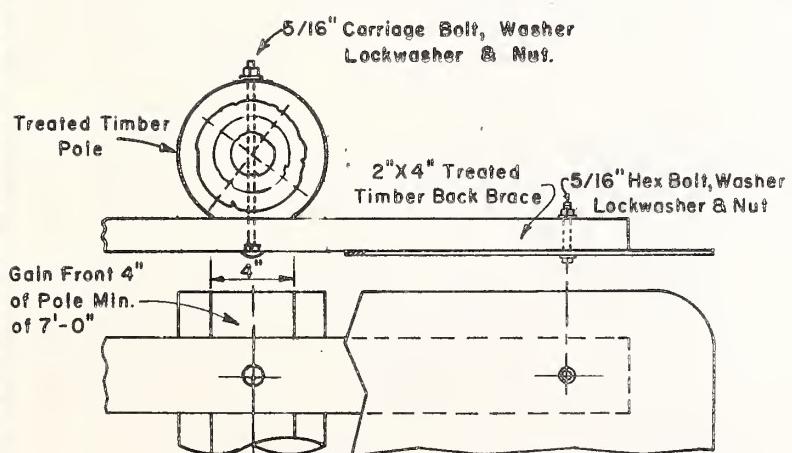
**State Highway Commission
Helena, Montana**

TYPICAL SIGN ERECTION

Approved
Lewis J. Shultz
State Highway Engineer



**TYPICAL ERECTION
48" x 60" REGULATORY SIGN**



**TYPICAL ERECTION
48" x 48" WARNING SIGN**

* For Pole Lengths and Foundation Depth-See Sign Plans "Sign Location and Erection" Sheet. For details see Std. Dwg. 88-76

NOTE

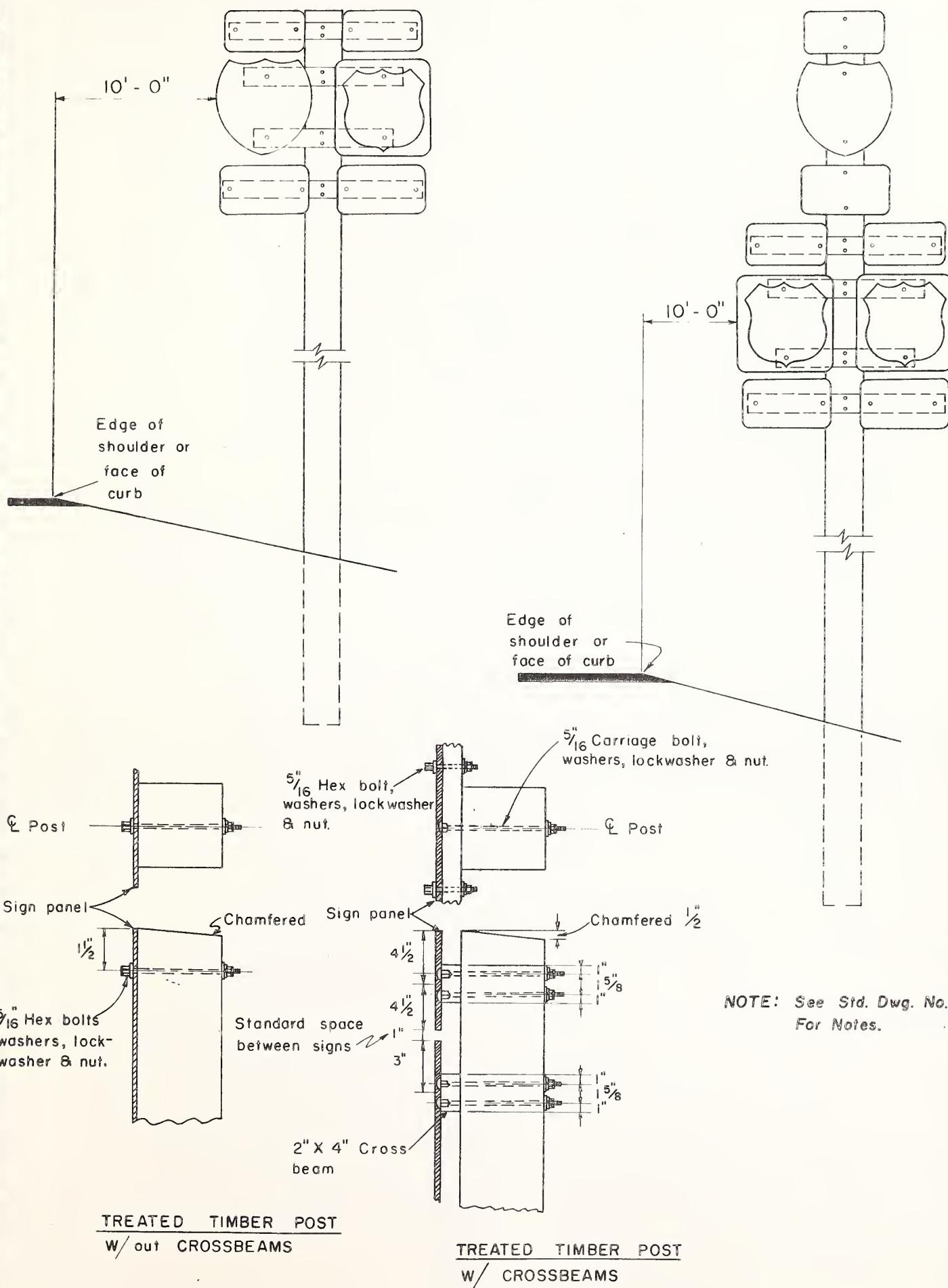
Signs greater than 10 sq. ft. shall be mounted 20' from shoulder edge. Caution should be taken to avoid placing signs in a position where it is not easily visible to the motorist.

SIGN FASTENING AND BACK BRACE DETAILS

Drawn 6-1-65

Revised 11-1-68
Effective 1-1-69

STANDARD DRAWING NO. 88-78

State Highway Commission
Helena, MontanaTYPICAL ROUTE MARKER ASSEMBLY
WITH TREATED TIMBER POSTApproved
J. C. Johnson 12-15-67
State Highway Engineer

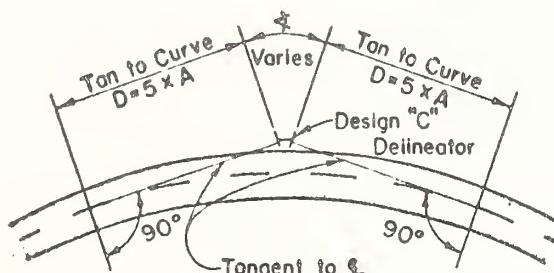
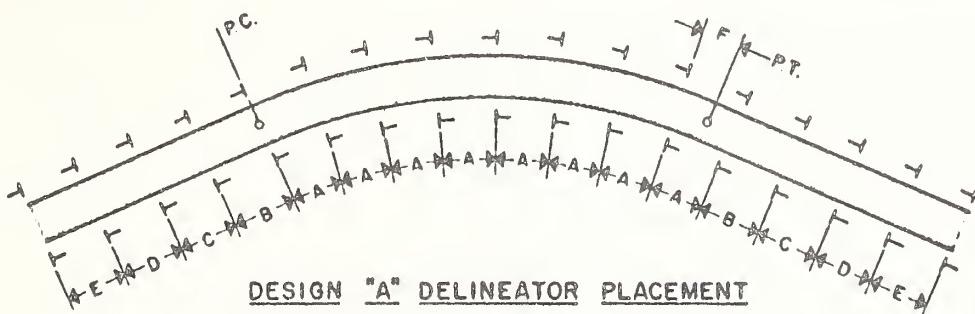
Drawn 5-1-65

REVISED 11-1-68 11-1-69
EFFECTIVE 1-1-69 1-1-70

STANDARD DRAWING NO. 88-92 15

State Highway Commission
Helena, MontanaDELINEATOR SPACING FOR
HORIZONTAL HIGHWAY CURVES

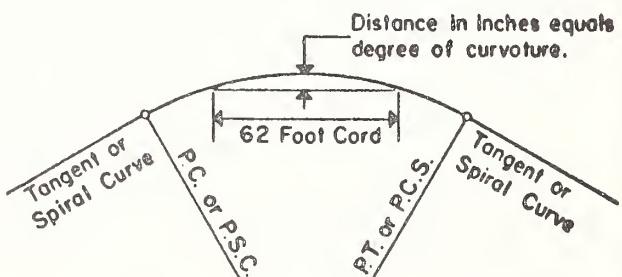
Approved

Lewis C. Chaffee P.E.
State Highway Engineer

Place Design "C" Delineators on curves sharper than $7^{\circ} 30'$. Position delineator faces perpendicular to tangent to center line of curve as shown. Spacing shall be as called for in Table below.

DEGREE OF CURVE	SPACING "A" ON CURVE	SPACING ON BOTH APPROACHES			
		B	C	D	E
0° TO 30'	200'	264'	264'	264'	264'
30°+ TO 1°	175'	264'	264'	264'	264'
1°+ TO 2°	125'	225'	264'	264'	264'
2°+ TO 3°	95'	170'	264'	264'	264'
3°+ TO 4°	80'	145'	240'	264'	264'
4°+ TO 6°	70'	125'	210'	264'	264'
6°+ TO 8°	55'	100'	165'	264'	264'
8°+ TO 12°	45'	80'	135'	264'	264'
12°+ TO 20°	35'	65'	115'	210'	264'
20° PLUS	25'	45'	75'	150'	264'

FIELD METHOD FOR DETERMINING DEGREE OF HORIZONTAL CURVES



NOTES:

- If distance F is 20 feet or more, add one regular "A" space as called for in the above table.
- See Standard Drawing No. 88-91 for Delineator Design Details.
- Post with delineators shall be placed on the right hand side facing oncoming traffic, 2'-0" clear from edge of shoulder or the face of curb, or as shown on the plans.
- Delineator button shall be a nominal 3" diameter reflector as specified by Standard Specifications.
- Delineator spacing on Tangent, shall be 264', unless otherwise noted on project plans.
- Interstate highways shall be continuously delineated.
- Posts shall be installed behind guard rail posts where there is guard rail installed along the highway.
- Where, under normal spacing, a delineator post falls within a crossroad, that post may be moved in either direction a distance not to exceed one quarter of the normal spacing.
- Primary & secondary highways may be continuously delineated in areas where ground blizzards are prevalent or in areas of hazardous alignment; otherwise, curves of 4° and sharper shall be delineated on the outside of the curve. Where vertical alignment is rolling, horizontal curves less than 4° may require delineation.

REVISED 4-15-68 II-22-68 4-4-69
EFFECTIVED II-1-68 I-1-69 7-1-69

STANDARD DRAWING NO. 90-02

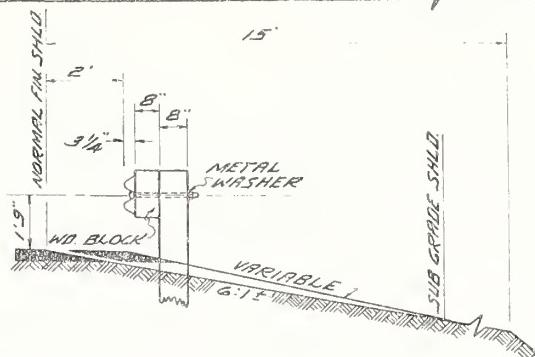
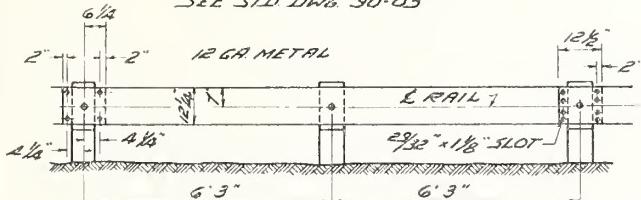
State Highway Commission
Helena, Montana

Approved

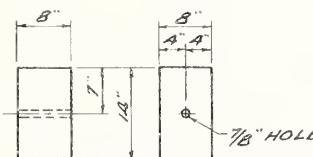
Lewis M. Sullivan
State Highway Engineer

METAL GUARD RAIL

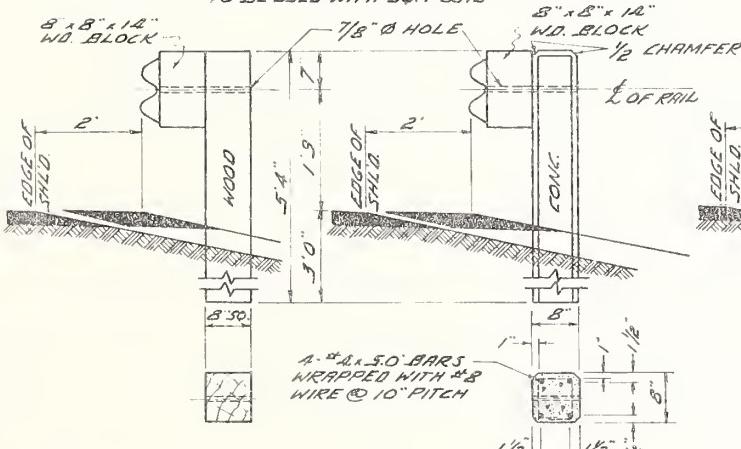
NOTE:
SEE STANDARD GUARD RAIL
FLARE & ANCHOR DETAIL FOR
STANDARD END TREATMENTS
SEE STD DWG 90-03



RAIL BEAM & SPLICE DETAIL



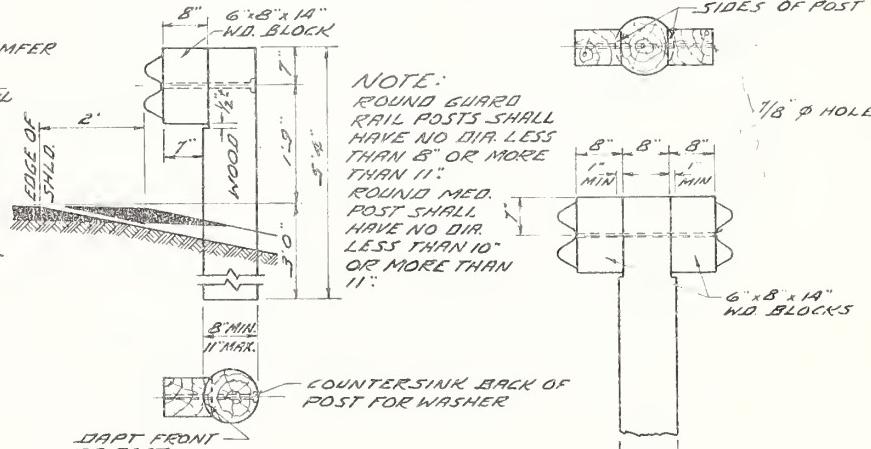
DETAIL OF 6"X8"X14" WOOD BLOCK
TO BE USED WITH SQ. POSTS



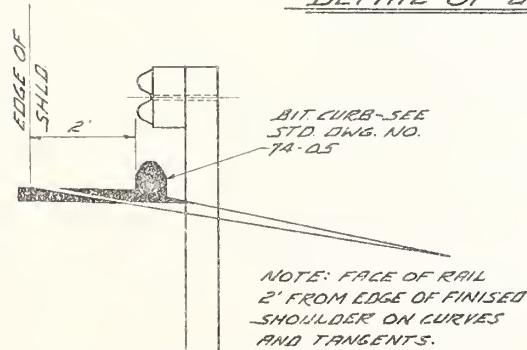
SQ. WD. POST

CONE. POST

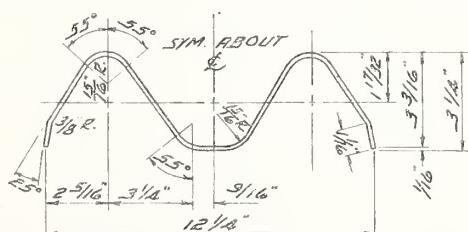
DETAIL OF 6"X8"X14" WOOD BLOCK
TO BE USED WITH ROUND POSTS



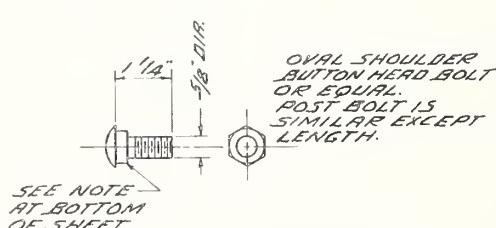
DETAIL OF ROUND MEDIAN POST



BITUM. CURB
WITH GUARD RAIL



RAIL SECTION



SPLICE BOLT & NUT

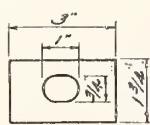
POSTS: SEE PLANS AND PROPOSAL FOR TYPE OF POSTS. POSTS SHALL BE BORED OR CRST WITH THE HOLES IN PLACE AS INDICATED IN THE ABOVE DETAILS.

WOOD BLOCKS: TO BE USED WITH WOOD AND CONC. POSTS. BLOCKS TO BE BORED WITH THE BOLT HOLES IN PLACE AS INDICATED IN THE ABOVE DETAILS.

RAIL: SEE PLANS AND PROPOSAL FOR TYPE OF RAIL. GALVANIZED RAIL SHALL BE GALVANIZED IN ACCORDANCE WITH ASTM A 93 OR ASTM A 123. STEEL GUARD RAIL SHALL CONFORM TO ARASHO M 180.

NOTE: ONLY ONE TYPE POST (SQ. OR ROUND) TO BE USED WITHIN ONE PROJECT.

A WASHER, OF DIMENSIONS APPROXIMATELY AS SHOWN AT LEFT, MADE OF 8 GAGE GALVANIZED STEEL, IS TO BE SUPPLIED FOR INSERTION UNDER HEAD OF BOLT WHICH FASTENS RAIL TO POST (BETWEEN HEAD AND RAIL). METAL MEDIAN RAIL WILL REQUIRE THE WASHER SHOWN ON BOTH SIDES.



REVISED 4-15-68 11-22-68

EFFECTIVE 11-1-68 1-1-69

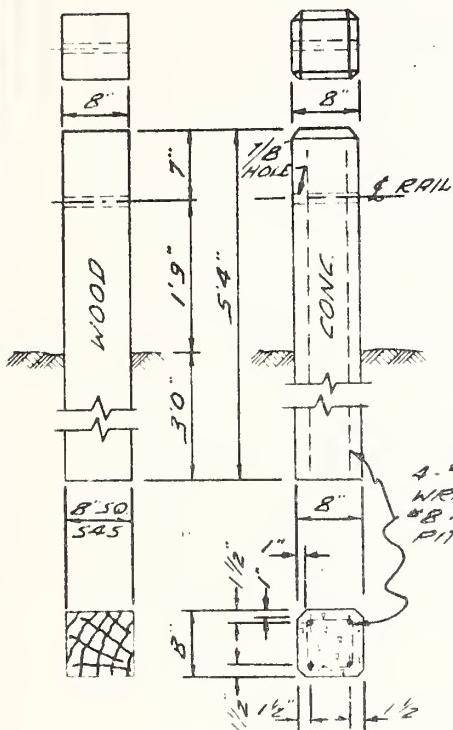
State Highway Commission

Helena, Montana

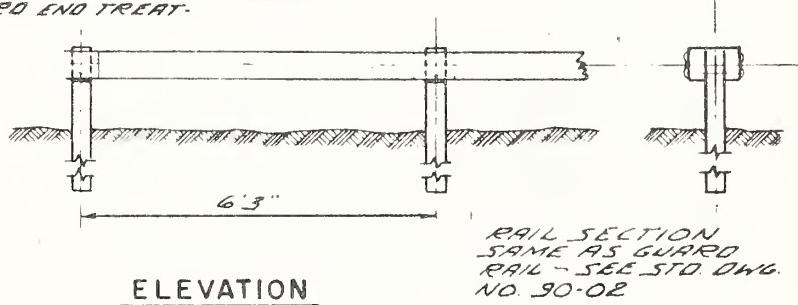
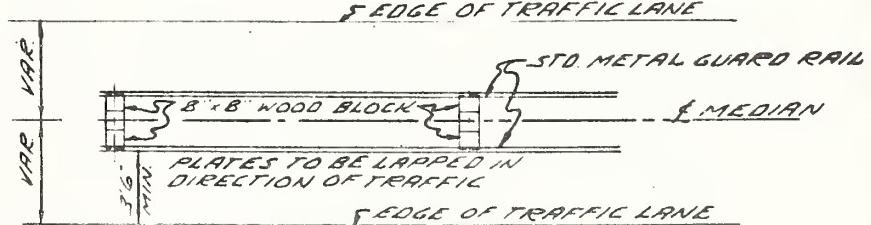
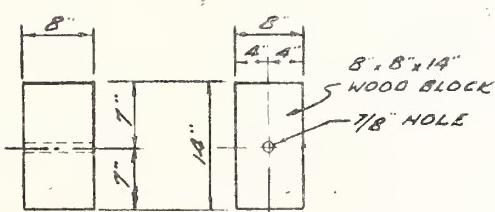
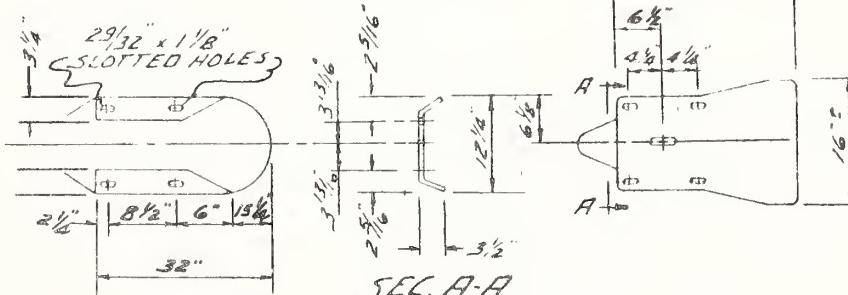
STANDARD DRAWING NO. 90-02 A

Approved 3/13/67
Lewis M. Ruttling
State Highway Engineer

METAL MEDIAN RAIL



NOTE: SEE STANDARD GUARD RAIL FLARE & ANCHOR DETAIL FOR STANDARD END TREATMENTS

DETAIL OF WOOD & CONC. POSTSDETAIL OF WOOD BLOCKTERMINAL SECTION
TO FIT POST SECTION SHOWN ABOVE

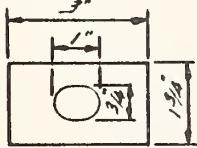
POSTS: SEE PLANS AND PROPOSAL FOR TYPE OF POSTS. POSTS SHALL BE BORED OR CAST WITH THE BOLT HOLES IN PLACE AS INDICATED IN THE ABOVE DETAIL.

WOOD BLOCKS: TO BE USED WITH WOOD AND CONCRETE POSTS. BLOCKS TO BE BORED WITH THE BOLT HOLES IN PLACE AS INDICATED IN THE ABOVE DETAIL.

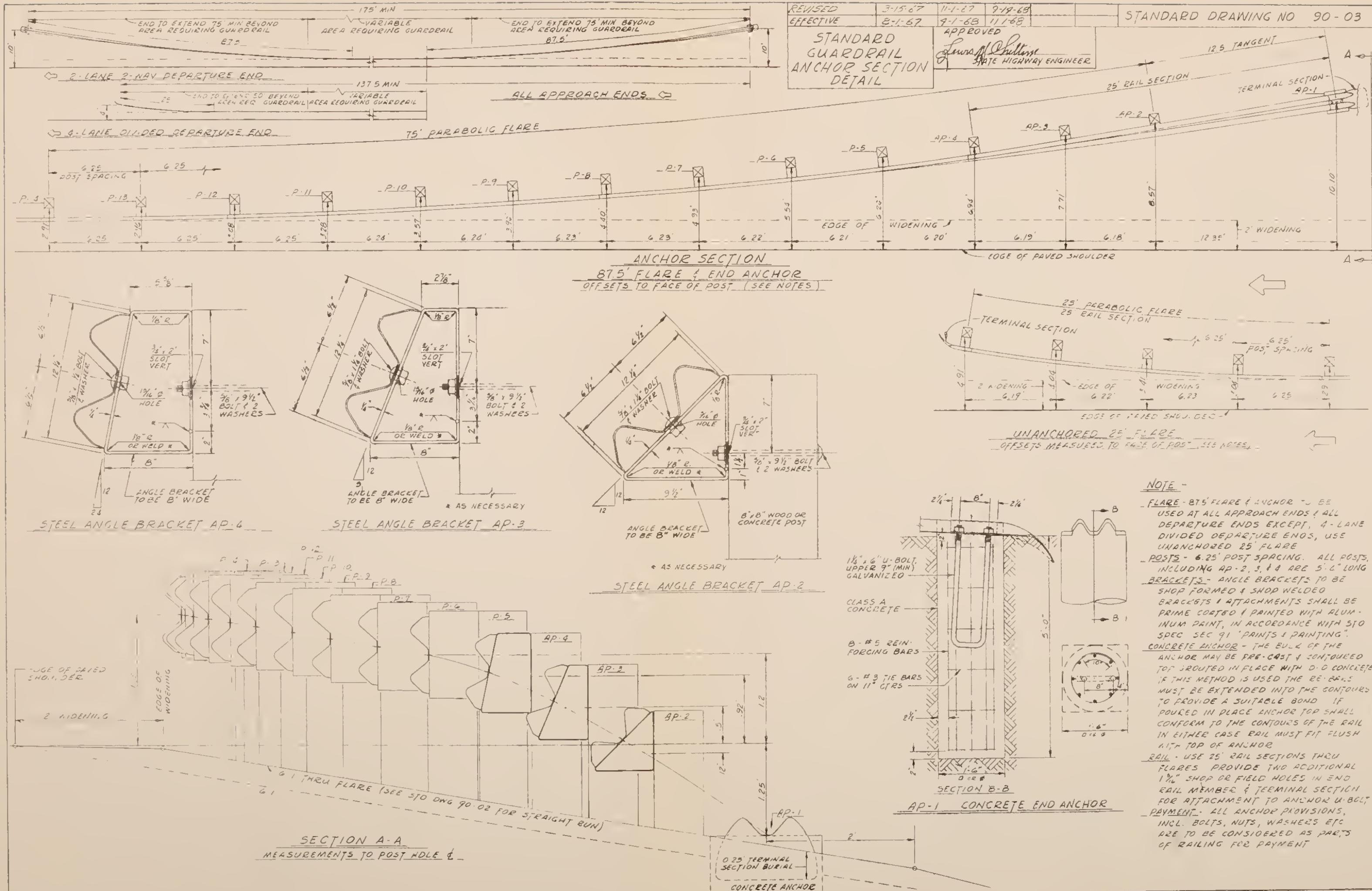
RAIL: SEE PLANS AND PROPOSAL FOR TYPE OF RAIL. GALVANIZED RAIL SHALL BE GALVANIZED IN ACCORDANCE WITH ASTM A 93 OR ASTM A 123.

ROUND POSTS: SEE STD. DWG. NO. 90-02 FOR DETAILS OF ROUND POSTS. ONLY ONE TYPE POST (SQ. OR ROUND) TO BE USED WITHIN ONE PROJECT.

STEEL GUARD RAIL SHALL CONFORM TO AASHO M 180.



A WASHER, OF DIMENSIONS APPROXIMATELY AS SHOWN AT LEFT, MADE OF 8 GAGE GALVANIZED STEEL, IS TO BE SUPPLIED FOR INSERTION UNDER HEAD OF BOLT WHICH FASTENS RAIL TO POST (BETWEEN HEAD AND RAIL). METAL MEDIAN RAIL WILL REQUIRE THE WASHER SHOWN ON BOTH SIDES.



DRAWN 3-15-67
EFFECTIVE 8-1-67REVISED
EFFECTIVE 4-1-68
11-1-68

STANDARD DRAWING NO. 90-04

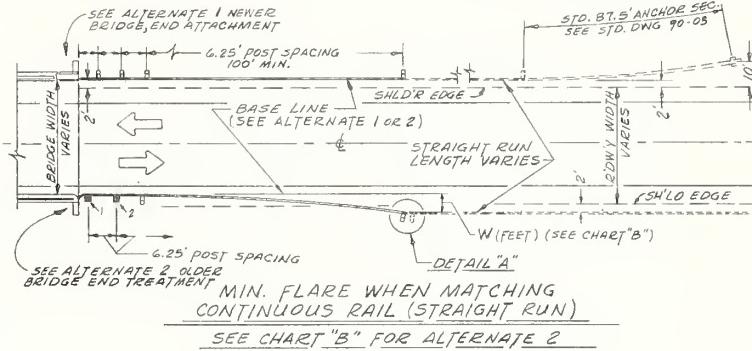
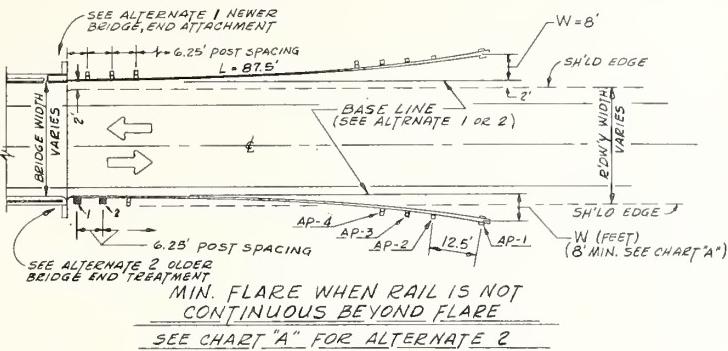
STATE HIGHWAY COMM.
HELENA, MONT.2 - LANE 2 - WAY BRIDGE END
TREATMENTAPPROVED
Lewis M. Bell 9-18-67
STATE HIGHWAY ENGINEER

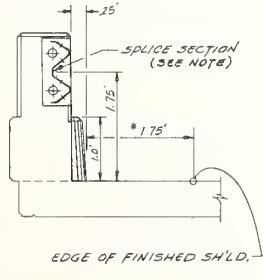
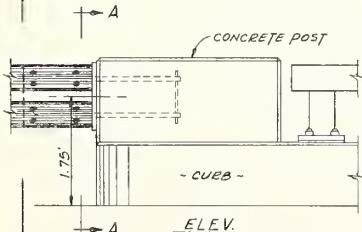
CHART "A"

DETERMINE W & L			
BRIDGE WIDTH	ROADWAY WIDTH	* W	L
28'	24'	8'	87.5'
	26'	9'	100'
	28'	10'	112.5'
	30'	11'	125'
	34'	13'	137.5'
	36'	14'	150'
	38'	15'	162.5'
	40'	16'	175'
	44'	18'	200'
30'	26'	8'	87.5'
	28'	9'	100'
	30'	10'	112.5'
	34'	12'	137.5'
	36'	13'	137.5'
	38'	14'	150'
	40'	15'	162.5'
	44'	17'	187.5'
32'	28'	8'	87.5'
	30'	9'	100'
	34'	10'	112.5'
	36'	12'	137.5'
	38'	13'	137.5'
	40'	14'	150'
	44'	16'	175'
34'	30'	8'	87.5'
	34'	10'	112.5'
	36'	11'	125'
	38'	12'	137.5'
	40'	13'	137.5'
	44'	15'	162.5'
36'	36'	10'	112.5'
	38'	11'	125'
	40'	12'	137.5'
	44'	14'	150'
38'	38'	10'	112.5'
	40'	11'	125'
	44'	13'	137.5'
40'	40'	10'	112.5'
	44'	12'	137.5'
44'	44'	10'	112.5'

* NOTE - THESE "W" DISTANCES INCLUDE 2 FEET ALLOWANCE FOR WIDENING FOR GUARDRAIL ON EACH SIDE OF ROADWAY.

CHART "B"

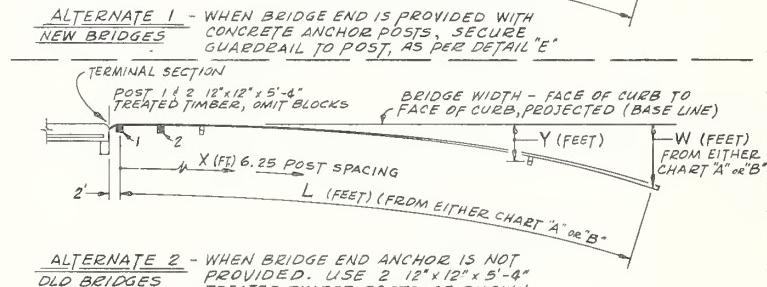
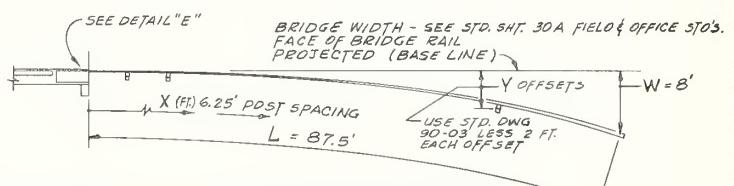
DETERMINE W & L			
BRIDGE WIDTH	ROADWAY WIDTH	* W	L
28'	24'	0	-
	26'	1'	75'
	28'	2'	75'
	30'	3'	75'
	34'	5'	75'
	36'	6'	75'
	38'	7'	75'
	40'	8'	87.5'
	44'	10'	112.5'
30'	26'	0	-
	28'	1'	75'
	30'	2'	75'
	34'	4'	75'
	36'	5'	75'
	38'	6'	75'
	40'	7'	75'
	44'	9'	100'
32'	28'	0	-
	30'	1'	75'
	34'	3'	75'
	36'	4'	75'
	38'	5'	75'
	40'	6'	75'
	44'	8'	87.5'
34'	30'	0	-
	34'	1'	75'
	36'	2'	75'
	38'	3'	75'
	40'	4'	75'
	44'	5'	75'
36'	36'	0	-
	38'	2'	75'
	40'	3'	75'
	44'	4'	75'
38'	38'	0	-
	40'	2'	75'
	44'	3'	75'
40'	40'	0	-
	44'	2'	75'
44'	44'	0	-



NOTE -
ATTACH INCOMING RAIL USING
8- 9/16" BOLTS. THE COST OF
FURNISHING SPLICE SECTION
& ALL MATERIALS PERTAINING
THESE SHALL BE INCLUDED
IN THE UNIT PRICE FOR
STEEL BRIDGE RAIL. SEE
S25-T5 STANDARD STEEL
BRIDGE RAIL TYPE NO. 5

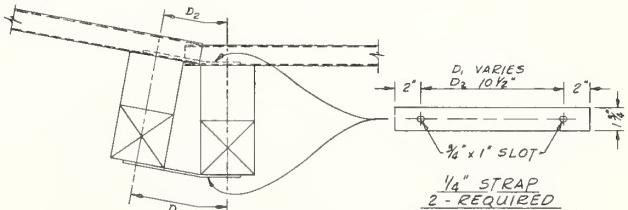
DETAIL "E"
BRIDGE END ANCHORAGE

BRIDGE WIDTH - BASE LINE TO BASE LINE AS DEFINED IN ALTERNATE 1 & 2 BELOW.
ROADWAY WIDTH - SHOULDER EDGE TO SHOULDER EDGE,
W - BASE LINE TO CENTER OF ANCHOR (CHART "A") FACE OF RAIL (CHART "B").
L - LENGTH OF PARABOLIC FLARE.
Y - POST OFFSET, FROM BASE LINE TO FACE OF POST, OR ANCHOR CTR.
(COMPUTE FROM FORMULA BELOW). FOR ALTERNATE 2.
X - BEGIN WITH ZERO AT FIRST POST OF FLARE & INCREASE BY 6.25'
FOR EACH ADDITIONAL POST.
IN CHART "B", 50:1 TAPERS MAY BE USED WHEN "W" IS 2' OR LESS.



POST	FORMULA
* ALL, EXCEPT AP-4, AP-3 AP-2, AP-1	$Y = \frac{W X^2}{L^2} + .91'$
AP-4	$Y = \frac{W X^2}{L^2} + .57'$
AP-3	$Y = \frac{W X^2}{L^2} + .48'$
AP-2	$Y = \frac{W X^2}{L^2} + .42'$
AP-1	$Y = \frac{W X^2}{L^2} **$

LAP IN DIRECTION OF TRAVEL

DETAIL "A"
FLARE TO STRAIGHT RUN CONNECTION

NOTES -
ALL APPROACH BRIDGE ENDS REQUIRE FLARE & ANCHOR TREATMENT.
SECURE GUARDRAIL TO CONCRETE END POST ON BRIDGE WHEN PROVIDED,
ALTERNATE 1. GENERALLY, OLDER STRUCTURES WILL NOT ALLOW
SUCH ATTACHMENT. ALTERNATE 2, WITH 2- 12" x 12" x 5'-4" TREATED
TIMBER POSTS OMITTING BLOCKS, SHALL BE USED.

DETAIL "A" MAY BE OMITTED, WHEN MATCHING FLARE TO CONTINUOUS
RAIL, IF "W" IS TWO FEET OR LESS.

SEE STD. DWG. NO. 90-03 FOR DETAILS OF AP-4, AP-3, AP-2 BRACKETS &
AP-1 CONCRETE ANCHOR.

SEE STD. DWG. NO. 90-03 FOR DETAILS OF 87.5' ANCHOR SECTION AT END OF
STRAIGHT RUN, & WHERE 87.5' LENGTH IS CALLED FOR IN CHART "A" & "B".

REVISED	11-1-67	4-15-68	4-4-68
EFFECTIVE 8-1-67	4-1-68	11-1-68	7-1-69

EFFECTIVE 8-1-67

11-1-67	9-15-68	4-4-69
4-1-68	11-1-68	7-1-69

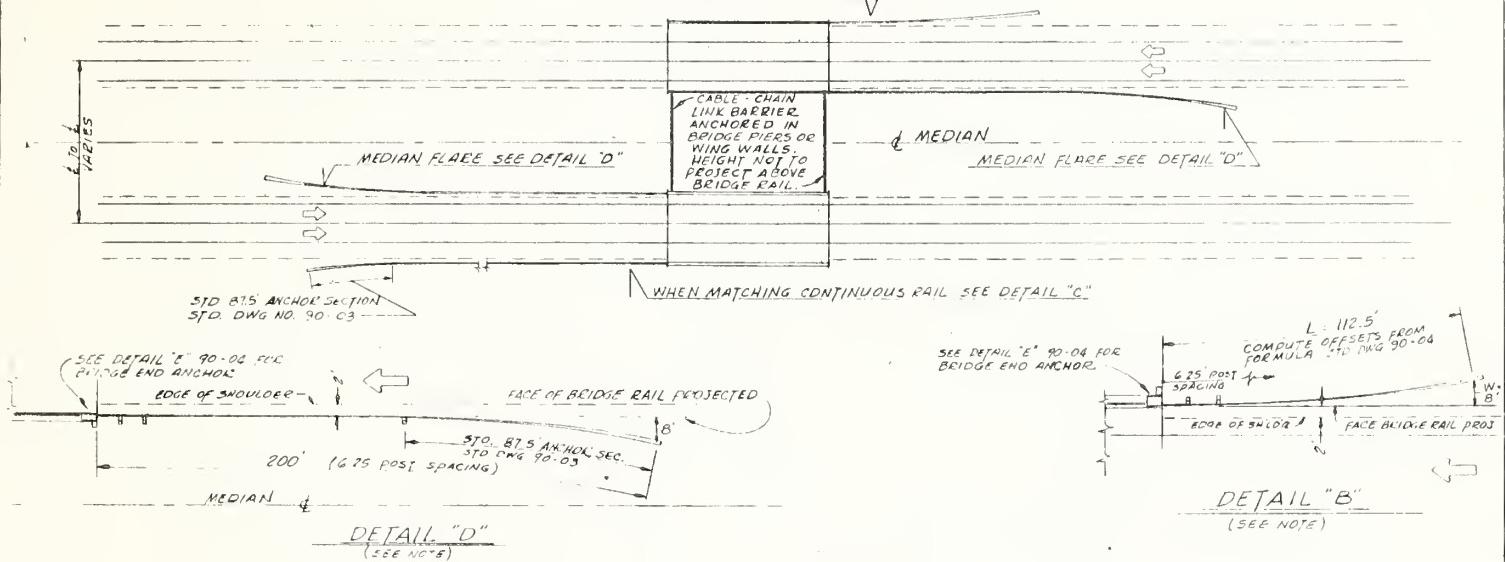
STATE HIGHWAY COMM
HELENA, MONT.

MULTILANE BRIDGE END & BRIDGE PIER TREATMENT

STANDARD DRAWING NO 90-05

APPROVED
Lewis M. Shultz 7-18-67
STATE HIGHWAY ENGINEER

WHEN RAIL NOT CONTINUOUS SEE DETAIL "B"



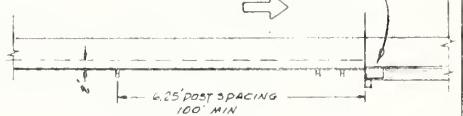
NOTES -

ALL APPROACH BRIDGE ENDS REQUIRE FLARE & ANCHOR TREATMENT.
BRIDGES WITH FULL SHOULDER WIDTH REQUIRE A MINIMUM CALL
TREATMENT OF 12' 5" ON OUT SIDE SHOULDER & 200' ON MEDIAN SIDE.
FOR LESS THAN FULL SHOULDER WIDTH REFER TO STD. DWG. 90-04 CHART 'A' OR B

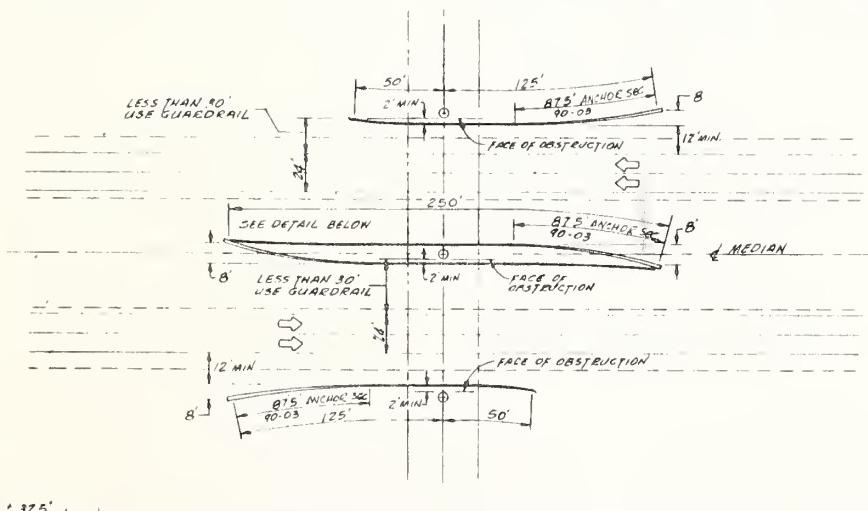
SEE STD DWG. 90-09 FOR 87.5' ANCHOR SECTION NOTED IN DETAIL "D"

DETAIL "B", "C", "D" - IF BRIDGE END ANCHOR POST IS NOT PROVIDED SEE
ALTERNATE 2 STD DWG 90-04

SEE DETAIL "E" 90-04 FOR
BRIDGE END ANCHOR



DETAIL "C"



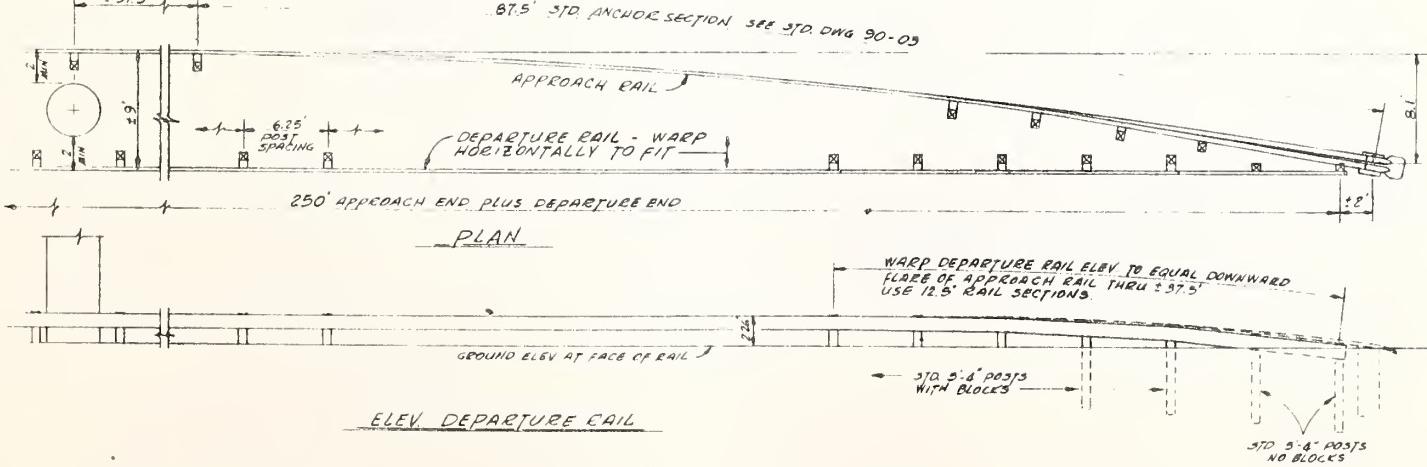
NOTES -

BRIDGE PIERS OR OBSTRUCTIONS LESS THAN 30' FROM EDGE OF NEAREST TRAFFIC LANE REQUIRE GUARDRAIL, EITHER CONTINUOUS OR PER REQUIREMENT OF FLARE & ANCHOR TREATMENT SHOWN

SEE STD. DWG 90-03 FOR 87.5' ANCHOR
SECTION DETAILS.

SEE STD. DWG. 90-03 FOR 25' UNANCHORED
DEPARTURE PLACE AS LAST HALF OF 50'
STRAIGHT RUN BEYOND OBSTRUCTION ON
OUTSIDE SHOULDERS.

WHEN GUARDRAIL INSTALLATIONS ARE MORE THAN 2' FROM THE EDGE OF THE SHOULDER, THE FILL SLOPE SHALL BE A 10:1 SLOPE FROM THE EDGE OF SHOULDER TO THE FACE OF GUARDRAIL.



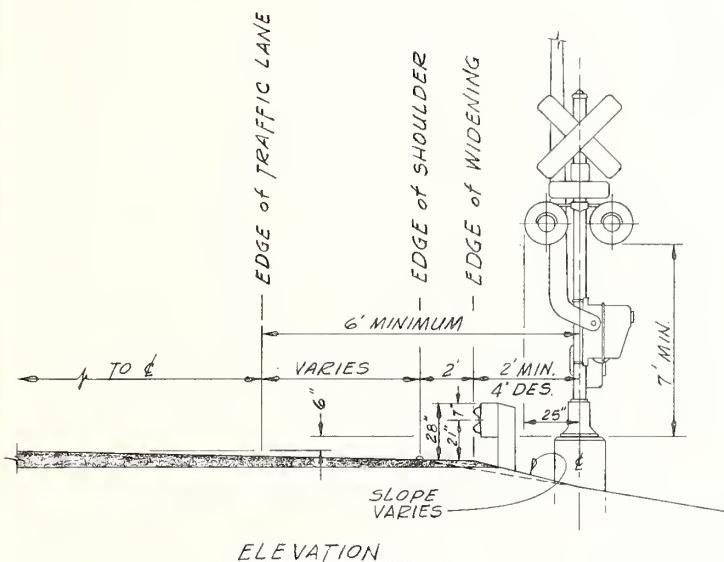
REVISED 11-1-67
EFFECTIVE 9-1-68

STANDARD DRAWING NO. 90-08

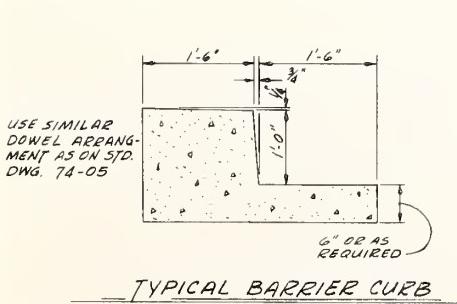
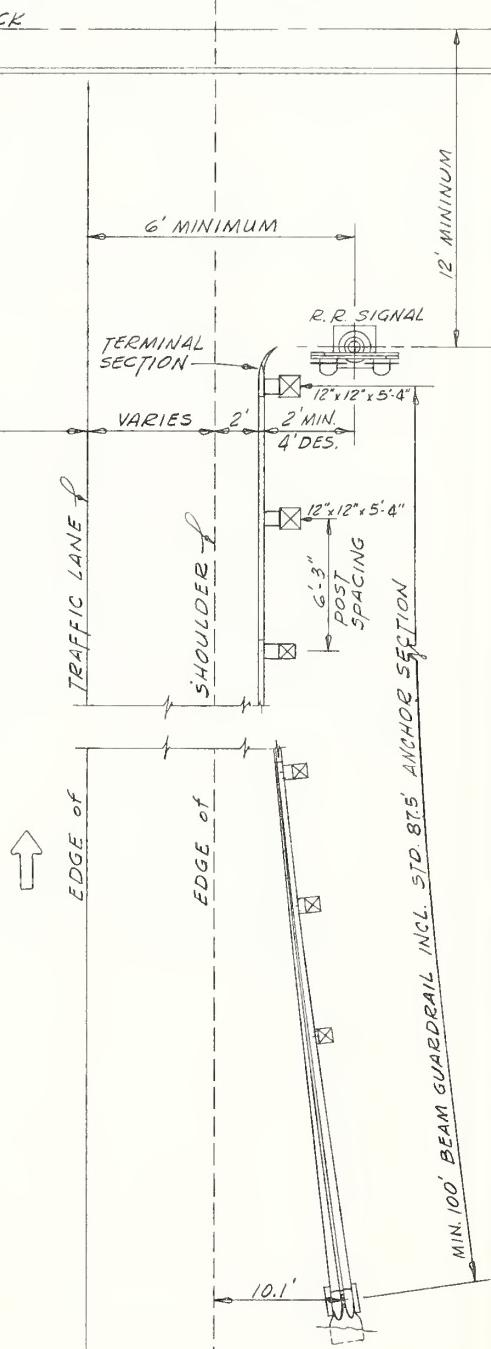
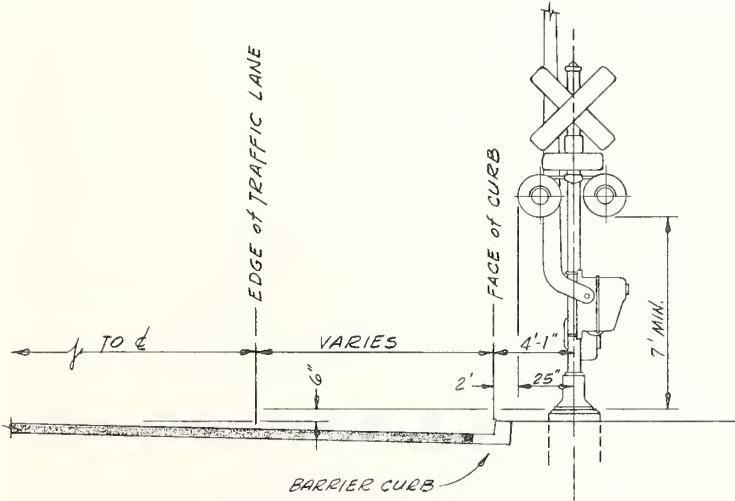
STATE HIGHWAY COMMISSION
HELENA, MONTANA

GUARDRAIL FOR
GRADE CROSSING PROTECTION

APPROVED
Lewis M. Cluffins 7-18-67
STATE HIGHWAY ENGINEER



IN EVERY CASE WHERE THERE IS NO BARRIER TYPE CURB, GUARDRAIL SHALL BE INSTALLED UNLESS SUCH INSTALLATION IS FOUND TO BE IMPRACTICABLE.



NOTE -

SEE BULLETIN NO. 6, "RECOMMENDED PRACTICES FOR RAILROAD - HIGHWAY GRADE CROSSING PROTECTION", ASSOCIATION OF AMERICAN RAILROADS, FOR ADDITIONAL DETAILS OF SKewed CROSSINGS.

SEE STD. DWG. 90-03 FOR ANCHOR SECTION DETAILS.

DRAWN 9-5-69

REVISED
EFFECTIVE 7-1-70

STANDARD DRAWING 90-17

STATE HIGHWAY COMMISSION
HELENA, MONTANA

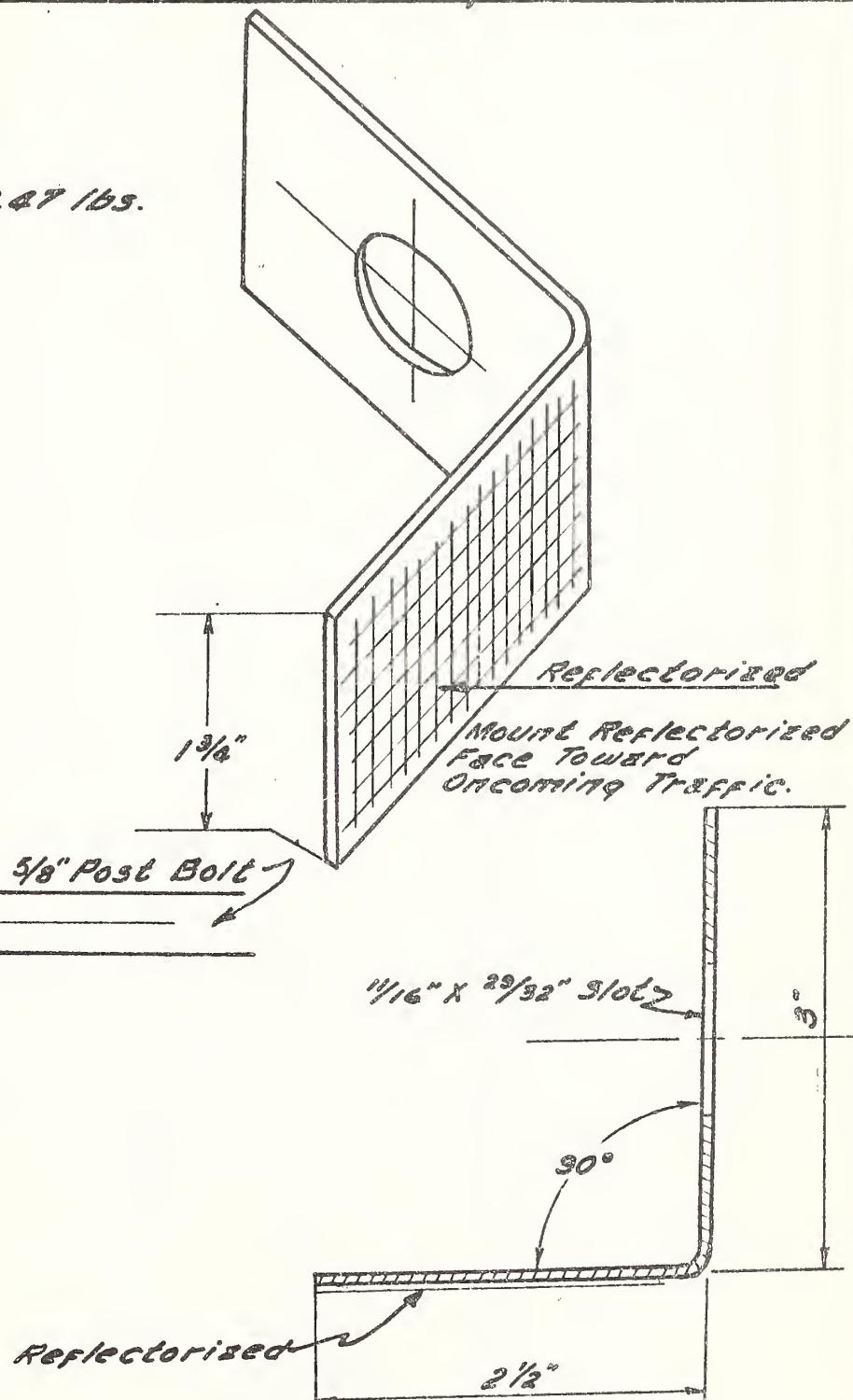
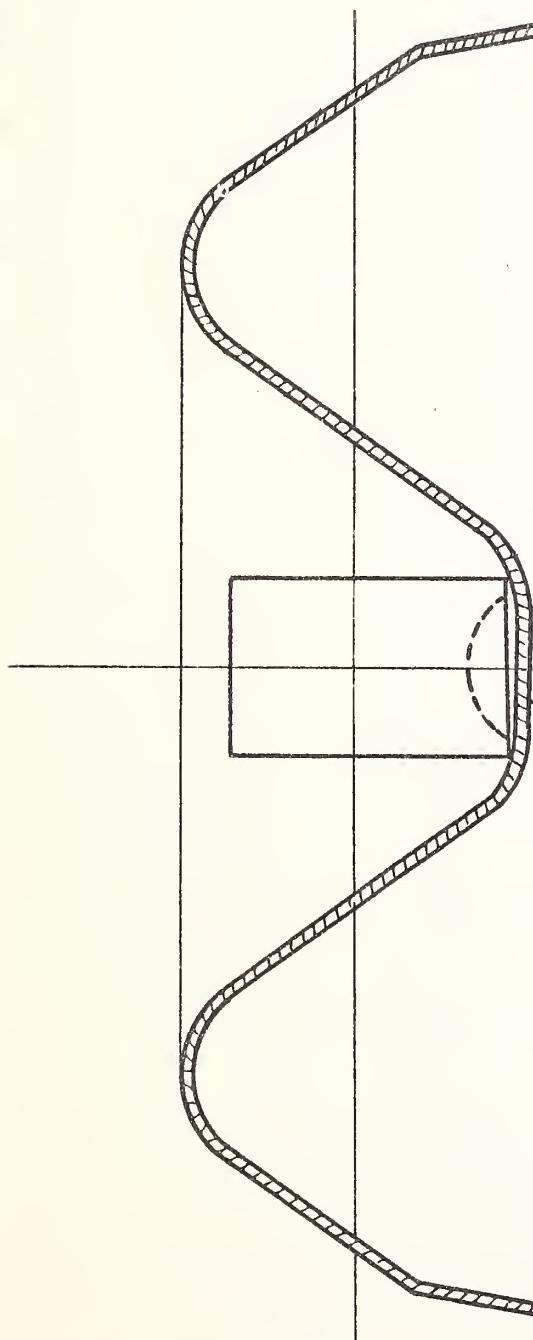
REFLECTOR - WASHER

APPROVED
Lemuel W. Phillips 9-5-69
STATE HIGHWAY ENGINEER

Material - 8 Gage

Galvanized

Approximate Weight 0.27 lbs.



All sections of guard rail shall have reflector-washers installed every 25 ft. except for the turned down anchor and departure sections. Reflector-washers are not required on bridge end, bridge pier or grade crossing protection guard rail.

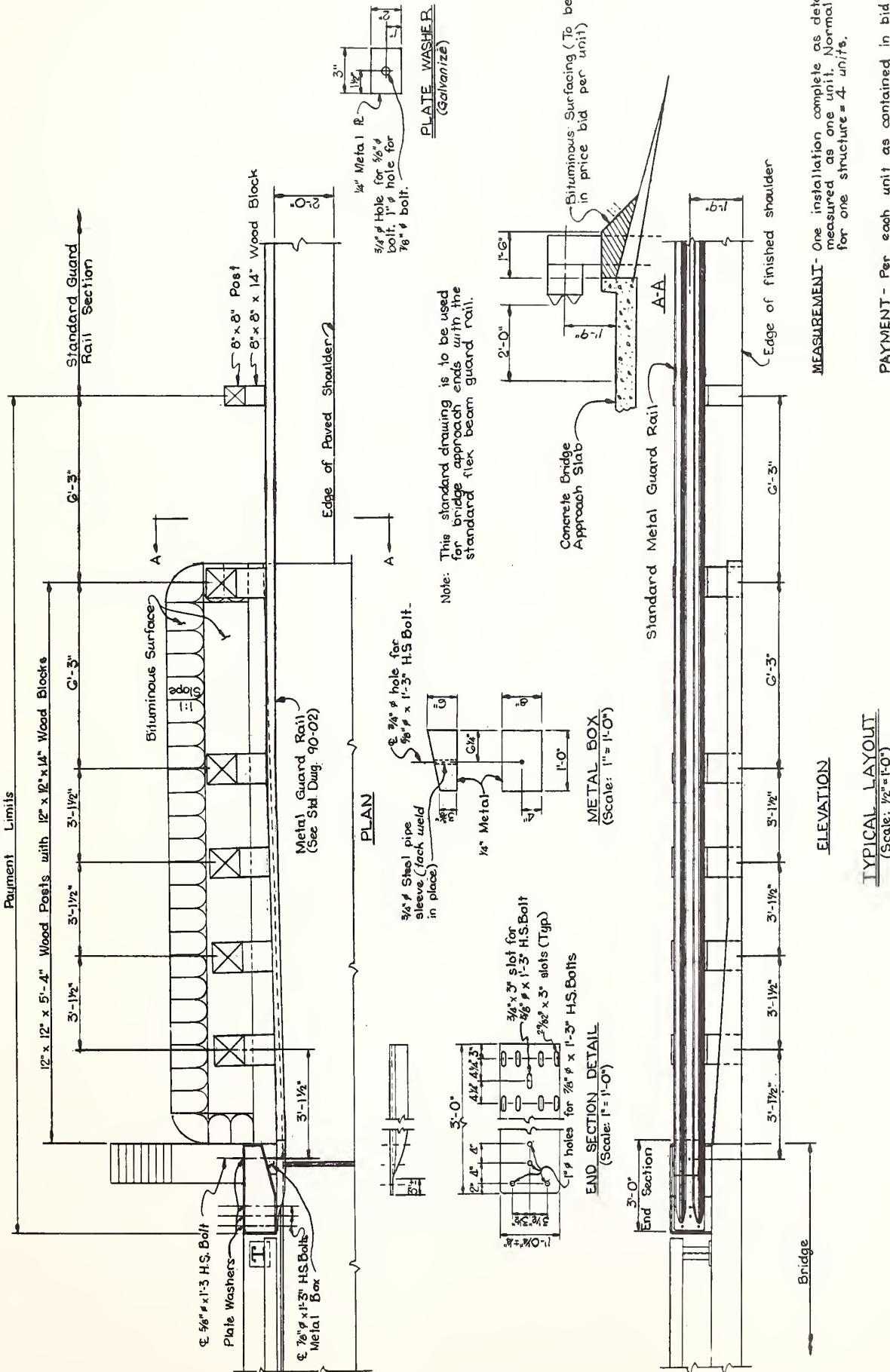
The use of reflectors will replace the need for the rectangular washers required to fasten rail to post.

Reflector-washers to be included in the unit price per linear foot of guard rail.

APPROVED:
James C. Allen, PE
STATE HIGHWAY ENGINEER
STANISLAUS COUNTY, CALIFORNIA

STATE HIGHWAY COMMISSION **FLEX BEAM GUARD RAIL BRIDGE APPROACH**

Equipment limits



CABLE GUARD RAIL

* The CABLE GUARD RAIL Drawing No. 90-06
* effective 1-1-69 remains unchanged except for
* the drawing number. Please change the number
* on this drawing to 90-20 and insert in your
* book in the proper sequence.

* The CABLE GUARD RAIL DRIVEWAY ANCHOR SECTION *

* Drawing No. 90-07 effective 1-1-69 remains unchanged *

* except for the drawing number. Please change the *

* number on this drawing to 90-21 and insert in your *

* book in the proper sequence.

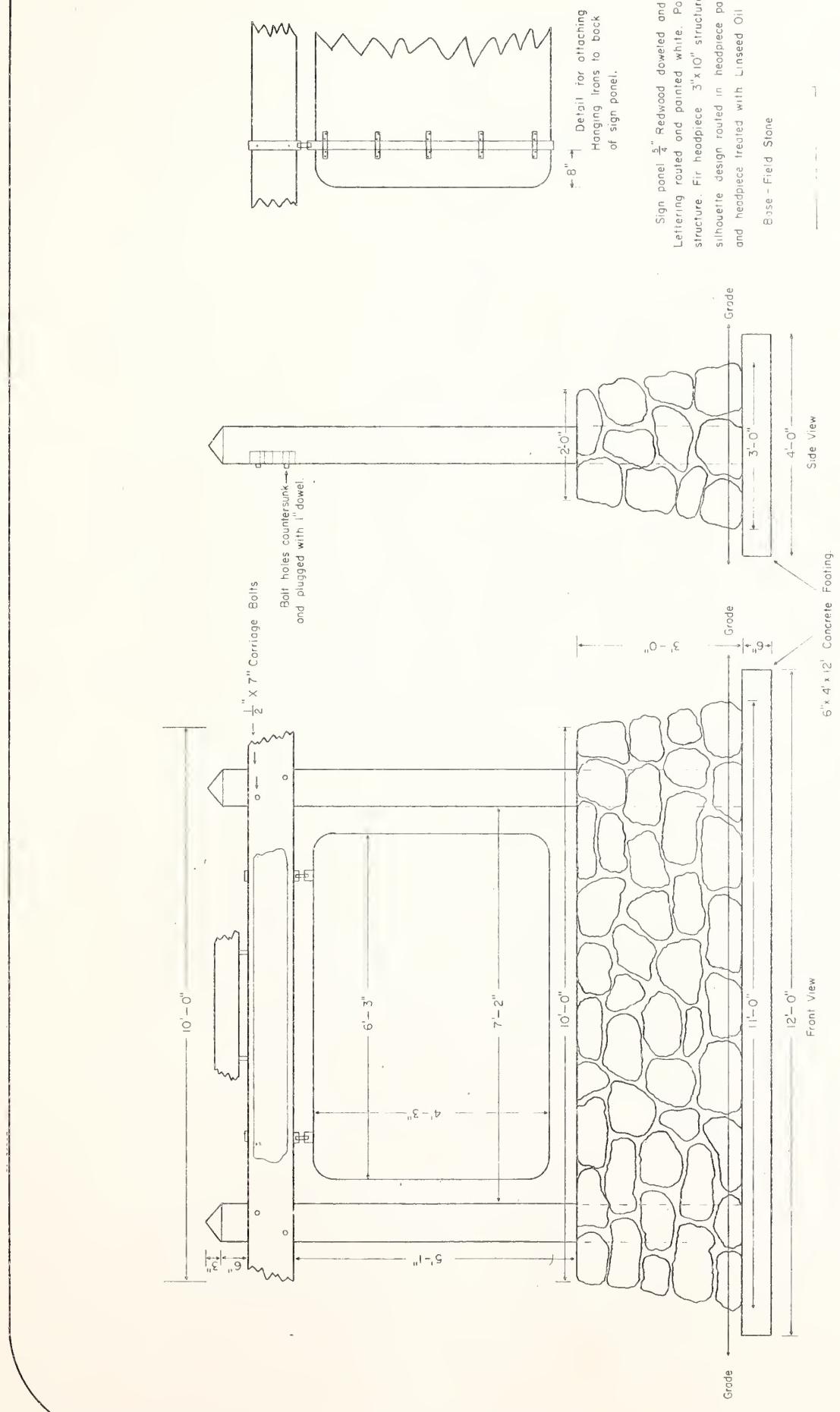
Drawn 6-2-69

REVISED
EFFECTIVE 7-1-69

STANDARD DRAWING NO. 100-13

State Highway Commission
Helena, Montana

HISTORICAL MARKER

Approved
F. C. Miller
State Highway Engineer

MONTANA HIGHWAY DEPARTMENT
HISTORICAL MARKER

STATE HIGHWAY COMMISSION
HELENA, MONTANA 59601

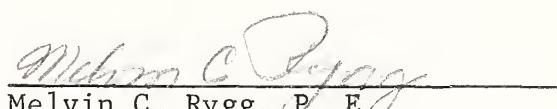
APRIL 1, 1970

STANDARD DRAWING BOOK

We are sending the following additions and/or revisions effective April 1, 1970, to be included in your present Standard Drawing Book, the grey covered one, original issue January 1, 1969.

11-04	Roadway Embankment at Bridge Ends
39-14(A)	Standard Concrete Approach Slab to Structures
39-14(B)	Standard Concrete Approach Slab to Structures
39-15(A)	Standard Concrete Approach Slabs to Structures with U-Type Abutments
39-15(B)	Standard Concrete Approach Slabs to Structures with U-Type Abutments
50-05	Concrete Drainage Chute
51-03	Backfill Retainer and Cutoff Wall for Vehicular Underpass
54-03	Bedding Material
59-04	Vehicular Underpass
73-09	Concrete Edge Protection for Concrete Pipe Culverts
73-10	Concrete Edge Protection for Concrete Arch Culverts
77-06	Curb Inlet Box and Cover
90-18	Flex Beam Guard Rail Bridge Approach

- NOTE: (1) Add these drawings to your book.
(2) We are also sending a complete new index, pages 1 through 6.
You should destroy the old index, pages 1 through 6.
(3) Also note several drawings have been deleted as of April 1, 1970.


Melvin C. Rygg, P. E.
Office Engineer



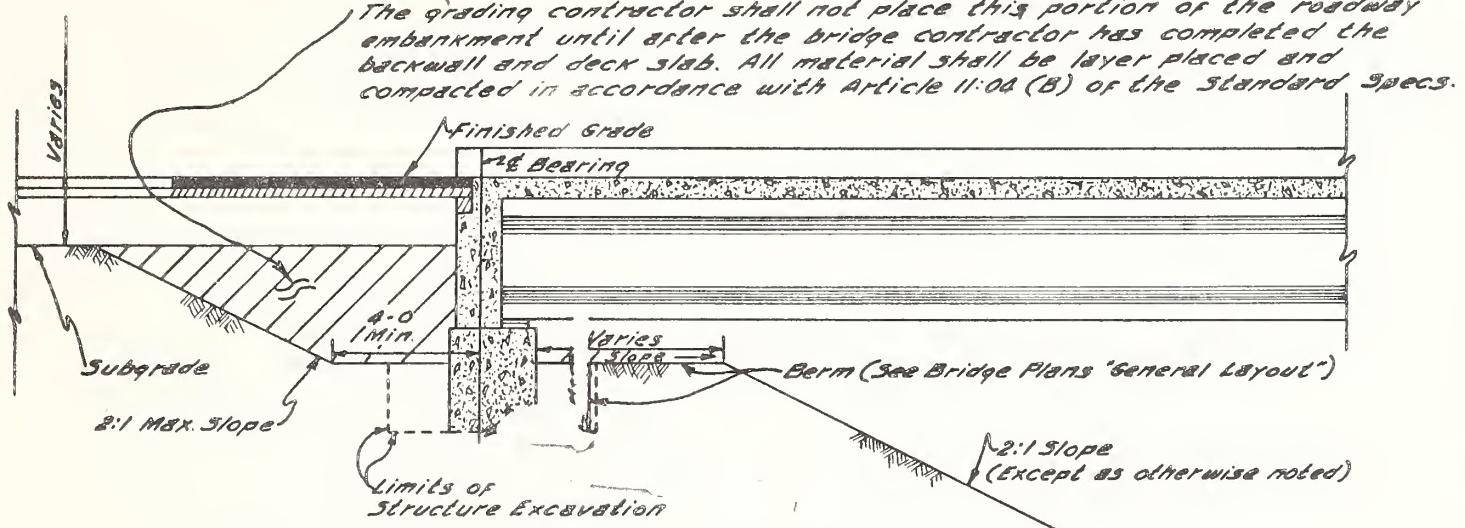
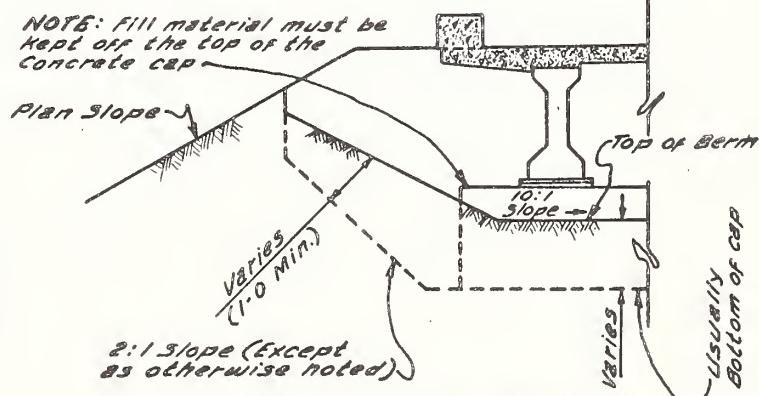
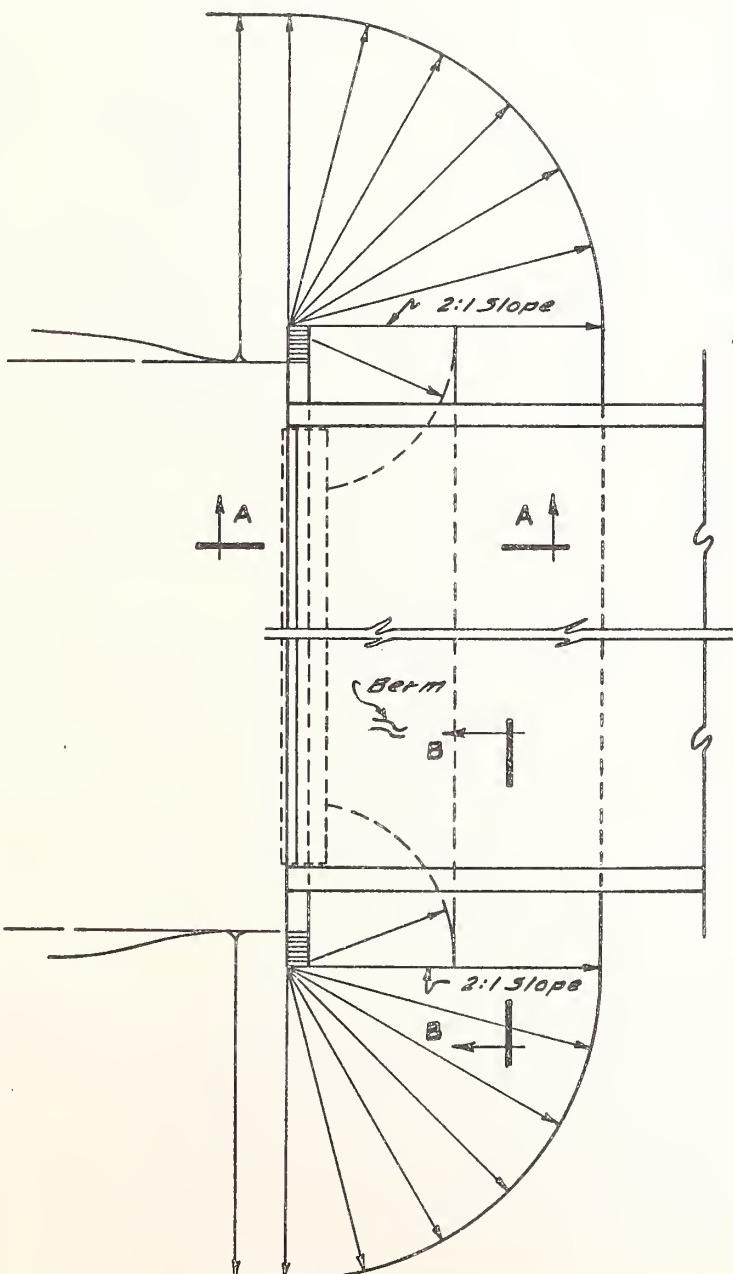
REVISED	4-16-69	6-1-69	9-23-69		
EFFECTIVE	6-1-69	7-1-69	1-1-70		

STANDARD DRAWING NO. 11-04

State Highway Commission
Helena, Montana

ROADWAY EMBANKMENT AT BRIDGE END

Approved

F. W. G. 5/2/69
State Highway EngineerSECTION A-AVIEW B-B
AT FINISHED BRIDGE END

PLAN VIEW AT FINISHED BRIDGE END

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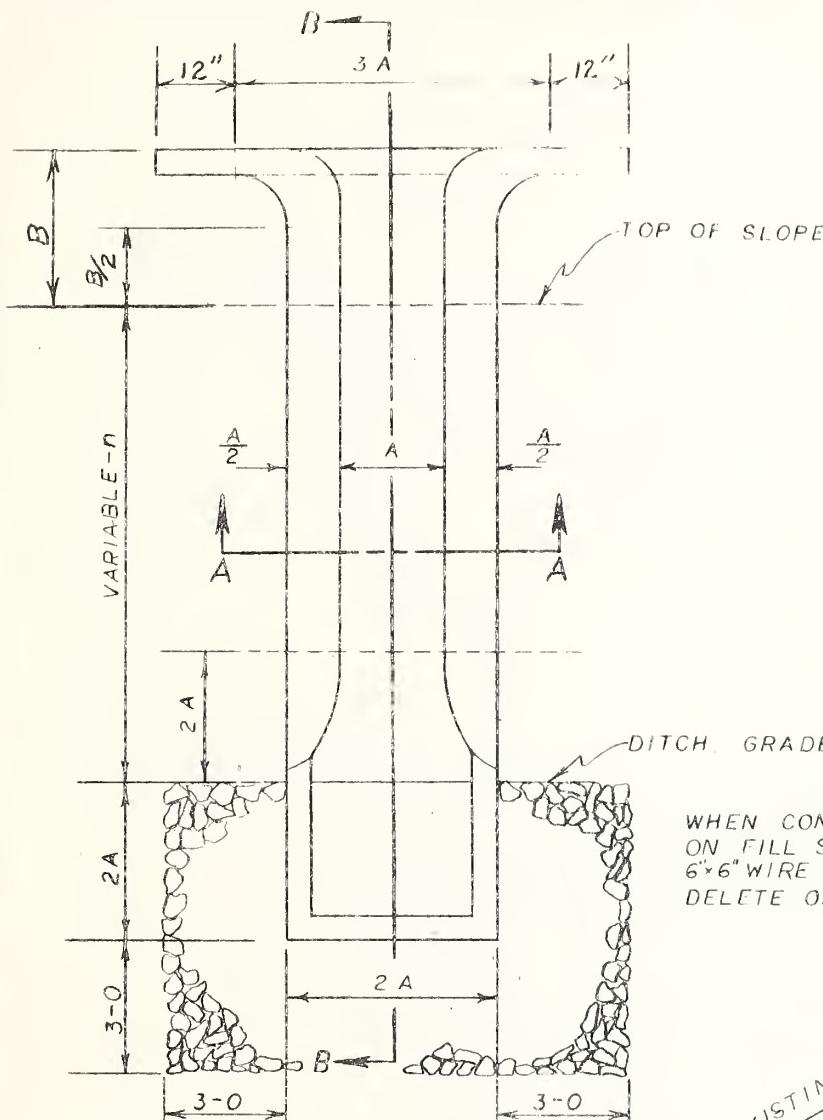
Revised 6-1-69
Effective 7/1-69

STANDARD DRAWING NO. 50-05

STATE HIGHWAY
COMMISSION
HELENA, MONTANA

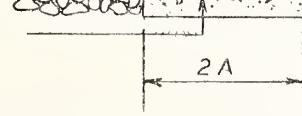
CONCRETE DRAINAGE CHUTE

Approved
Lester Shull 5/21/69
State Highway Engineer



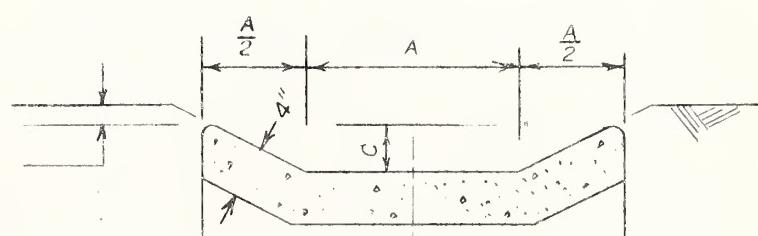
BANK PROTECTION
SEE NOTES

DEPRESS C



SECTION B-B

DEPRESS 6"



SECTION A-A

DIMENSIONS			QUANTITIES
A	B	C	CONCRETE CU.YD.
2-0	4-0	0-4	.63 cu.yd. / in x .051 cu.yd./in.ft.
3-0	4-0	0-6	1.06 cu.yd. / in x .077 cu.yd./in.ft.
4-0	8-0	0-8	2.05 cu.yd. / in x .100 cu.yd./in.ft.
5-0	8-0	1-0	2.61 cu.yd. / in x .128 cu.yd./in.ft.

*Excavation and bank protection to be included in the unit price bid for concrete

NOTES

SPECIFICATIONS: Montana State Highway Commission Standard Specifications for Road and Bridge Construction, adopted March 1, 1966 and any amendments thereto, and special provisions shall govern unless otherwise noted.

CONCRETE: All concrete shall be class AC-DC unless otherwise noted. Concrete shall conform to section 40 of the specifications. Concrete may be pneumatically applied.

*BANK PROTECTION: Bank protection shall be type 4 and shall conform to subsection 50.30 of the specifications. Thickness shall be 12".

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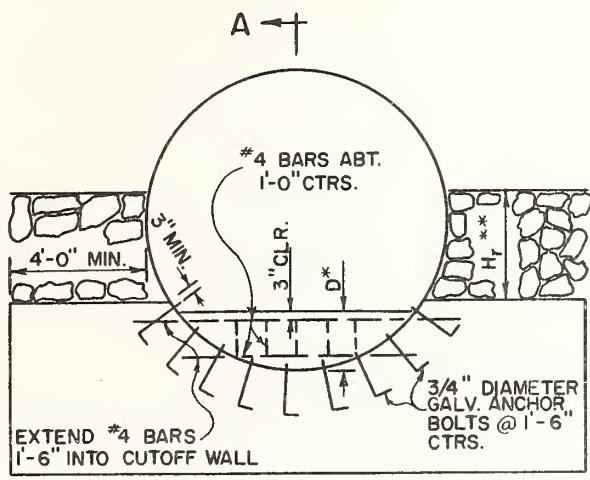
REVISED 5-1-65 11-20-68
EFFECTIVE 5-1-65 1-1-69

STANDARD DRAWING NO. 51 03

State Highway Commission
Helena, Montana

BACKFILL RETAINER & CUTOFF WALL
FOR VEHICULAR UNDERPASS

Approved
L. S. [Signature] 12-7-66
State Highway Engineer



A ←

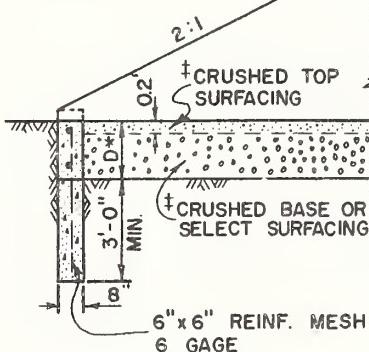
ELEVATION

* SEE STD. DWG. NO. 59-06

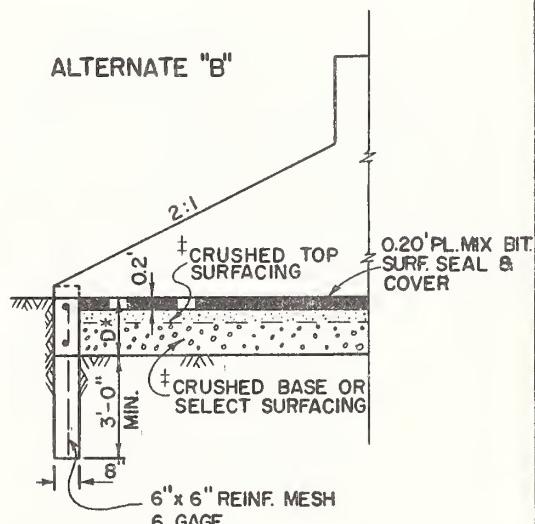
** H_r = HEIGHT OF RIPRAP (SEE ROAD PLAN)

† ON THE DESIGN 102, THE BACKFILL MATERIAL SHALL BE CRUSHED TOP SURFACING ONLY.

ALTERNATE "A"



ALTERNATE "B"



SECTION A-A

NOTE: CONCRETE SHALL BE CLASS "DD" OR EQUAL.

CONCRETE QUANTITIES ARE FOR ONE END ONLY.

REINFORCING MATERIAL TO BE INCLUDED IN UNIT PRICE BID PER CU. YD. CONC.

ANCHOR BOLTS TO BE INCLUDED IN THE UNIT PRICE BID PER LIN. FT. PIPE.

SURFACING QUANTITIES PER LINEAL FOOT									
DIAMETER (inches)	ALTERNATE "A"		ALTERNATE "B"						
	CUBIC YARDS		TON		CUBIC YARD		TONS BITUM. MAT'L.		
	TOP SURF.	CR. BASE OR SEL. SURF.	COVER MAT'L.	PLANT MIX	TOP SURF.	CR. BASE OR SEL. SURF.	PRIME	PLANT MIX	SEAL
102	0.100	—	—	—	—	—	—	—	—
126	0.047	0.156	0.0093	0.096	0.045	0.111	0.0009	0.0057	0.0009
162	0.073	0.489	0.0139	0.146	0.069	0.408	0.0014	0.0087	0.0014
180	0.073	0.446	0.0142	0.148	0.071	0.375	0.0014	0.0089	0.0014
198	0.088	0.712	0.0167	0.176	0.084	0.627	0.0017	0.0106	0.0017
210	0.074	0.333	0.0140	0.141	0.067	0.267	0.0014	0.0085	0.0014

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REVISED 1-1-68 11-20-68 7-15-69
EFFECTIVE 2-1-68 1-1-69 1-1-70

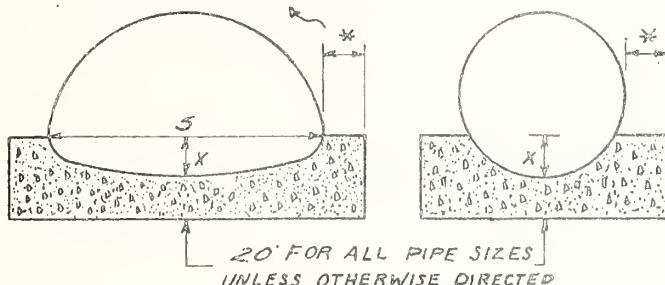
STANDARD DRAWING NO. 54-03

State Highway Commission
Helena, Montana

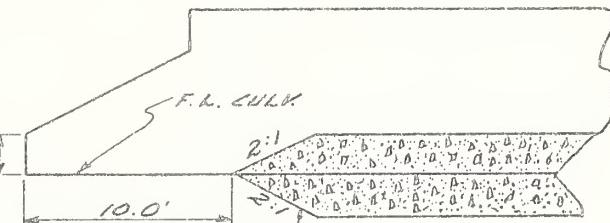
BEDDING MATERIAL

Approved
James M. Shullard
State Highway Engineer

*AS DIRECTED WITHIN 2.0' TO 6.0' FOR PIPES
GREATER THAN 60" DIAMETER OR SPAN.
2.0' FOR SMALLER PIPES.



FOR X DIST. SEE STD. DRAWINGS
NO'S. 59-01 59-03 59-04 & 59-05



10.0'
IF SUITABLE FOR
FOUNDATION, THIS
MATERIAL SHOULD
BE UNDISTURBED
AND BEDDING
AROUND PIPE
COMPOSED OF
EARTH TO PROVIDE
SEAL

SEE STD. SPECIFICATIONS
FOR GRADATION OF
BEDDING MATERIAL

CIRCULAR C.S.P. & S.S.P.P.C.

DIAMETER OF PIPE (IN.)	CU YDS. BEDDING MATL. REQ'D. PER LIN. FT. FOR 2.0' THICKNESS	DIAMETER OF PIPE (IN.)	CU YDS. BEDDING MATL. REQ'D. PER LIN. FT. FOR 2.0' THICKNESS
60	0.94	162	2.45
66	1.02	168	2.55
72	1.09	174	2.66
78	1.16	180	2.77
84	1.25	192	2.99
90	1.33	198	3.10
96	1.41	204	3.22
102	1.50	210	3.34
108	1.58	216	3.45
114	1.67	228	3.69
120	1.76	240	3.94
126	1.85	252	4.20
132	1.95		
138	2.04		
144	2.14		
150	2.24		
156	2.34		

STRUCTURAL PLATE PIPE ARCH

SPAN	RISE	CU YDS. BEDDING MATL. REQ'D. PER LIN. FT. FOR 2.0' THICKNESS	12:1 BEV.	2:1 BEV.	2:2 BEV.
12" CORNER PLATES					
6'7"	4'7"	1.16	1.16	1.16	1.16
6'9"	4'11"	1.23	1.23	1.23	1.23
7'3"	5'3"	1.19	1.19	1.19	1.19
7'11"	5'7"	1.30	1.30	1.30	1.30
8'7"	5'11"	1.37	1.37	1.37	1.37
9'4"	6'3"	1.47	1.47	1.47	1.47
9'9"	6'7"	1.44	1.44	1.44	1.44
10'8"	6'11"	1.63	1.63	1.63	1.63
11'5"	7'3"	1.74	1.74	1.74	1.74
11'10"	7'7"	1.68	1.68	1.68	1.68
12'6"	7'11"	1.80	1.80	1.80	1.80
12'10"	8'4"	1.75	1.75	1.75	1.75
31" CORNER PLATES					
14'0"	9'8"	2.13	2.13	2.13	2.13
15'4"	10'11"	2.31	2.31	2.31	2.31
16'6"	11'0"	2.36	2.36	2.36	2.36
17'11"	11'8"	2.53	2.53	2.53	2.53
19'3"	12'6"	2.77	2.77	2.77	2.77
20'5"	13'0"	2.91	2.91	2.91	2.91

STRUCT. PLATE PIPE ARCH
STOCK & VEHICULAR UNDERPASS

DESIGN	SPAN	RISE	CU YDS. BEDDING MATL. REQ'D. PER LF (2' THICK)
99	6'11"	8'6"	1.15
129	10'10 1/2"	9'11"	1.42
156	13'10"	11'9 1/2"	2.29
180	15'6"	13'10"	2.53
192	16'2"	14'10"	2.42

STRUCT. PLATE PIPE STOCK PASS

DESIGN	SPAN	RISE	CU YDS. BEDDING MATL. REQ'D. PER LF (2' THICK)
A	5'10"	6'6"	0.59
B	5'10"	7'7"	0.99

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REVISED	6-16-67	11-20-68
EFFECTIVE	8-1-67	1-1-69

STANDARD DRAWING NO. 59-04

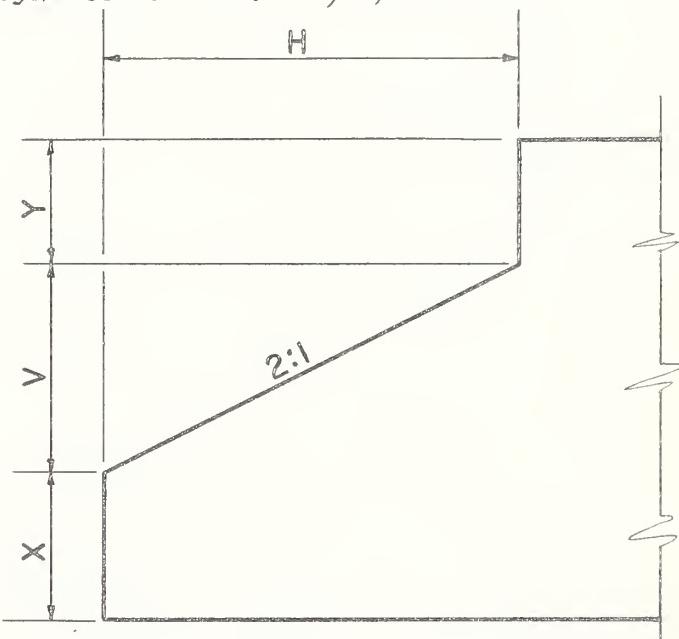
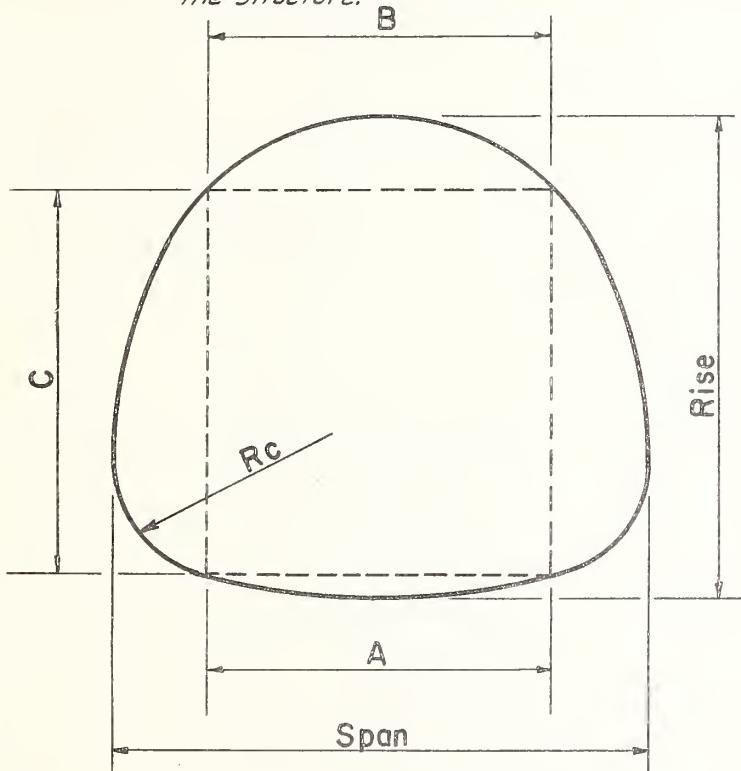
**State Highway Commission
Helena, Montana**

**STOCK & VEHICULAR UNDERPASS & DRAINAGE STRUCTURES
STRUCTURAL PLATE PIPE ARCH**

Approved
Lewis M. Sittler
State Highway Engineer

NOTE—These structures will be designated, in plans and proposals, as "Vehicular Underpass - Design 99", or whichever design may be required. Materials, installation and other provisions shall conform to the Standard Specifications.

The term "Vehicular Underpass" will be used, regardless of the use or purpose of the structure.



NOTE:

Height of cover shall not be less than 5.0 feet. Special design to be used for heights less than 5.0 feet.

Design	Span	Rise	A	B	C	H	V	X	Y
99	6'11"	8'6"	~	~	~	8'0"	4'0"	1'9"	2'9"
129	10'10½"	9'11"	~	~	~	8'0"	4'0"	3'2"	2'9"
156	13'10"	11'9½"	10'0"	8'6"	9'5"	8'0"	4'0"	3'8"	4'2"
180	15' 6"	13'10"	10'0"	10'0"	11'1½"	12'0"	6'0"	4'3"	3'7"
192	16' 2"	14'10"	12'0"	10'0"	12'0"	12'0"	6'0"	3'10"	5'0"

Design	Span	Rise	Corner Plate Radius (Rc)			
				MIN. GAGE	MAX. HEIGHT OF COVER (FEET)	
99	6' 11"	8' 6"	18"	10	15	
129	10' 10½"	9' 11"	31"	10	14	
156	13' 10"	11' 9½"	31"	10	12	
180	15' 6"	13' 10"	31"	10	11	
192	16' 2"	14' 10"	31"	10	11	

61

52

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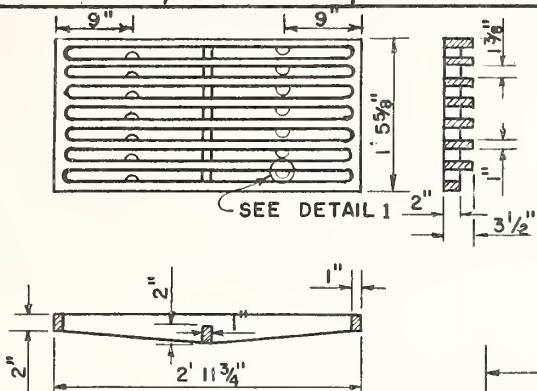
REVISED 3-20-67 11-20-68
EFFECTIVE 6-1-67 1-1-69

STANDARD DRAWING NO. 77-06

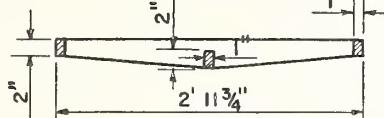
State Highway Commission
Helena, Montana

Approved
Lewis M. Putlid
State Highway Engineer

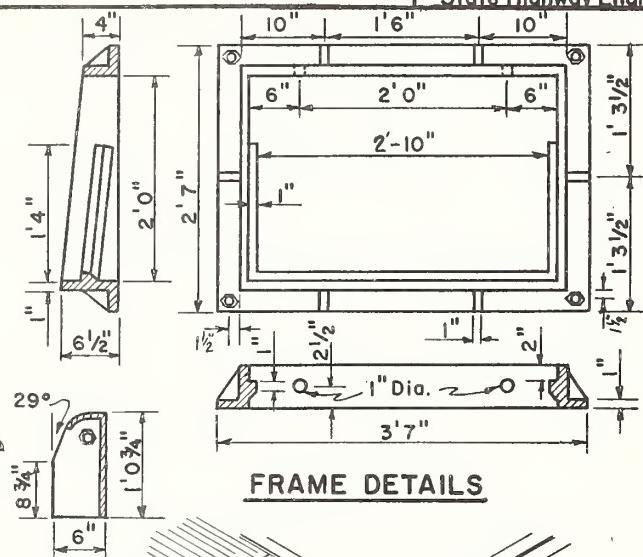
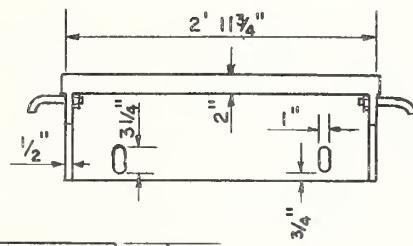
CURB INLET BOX AND COVER



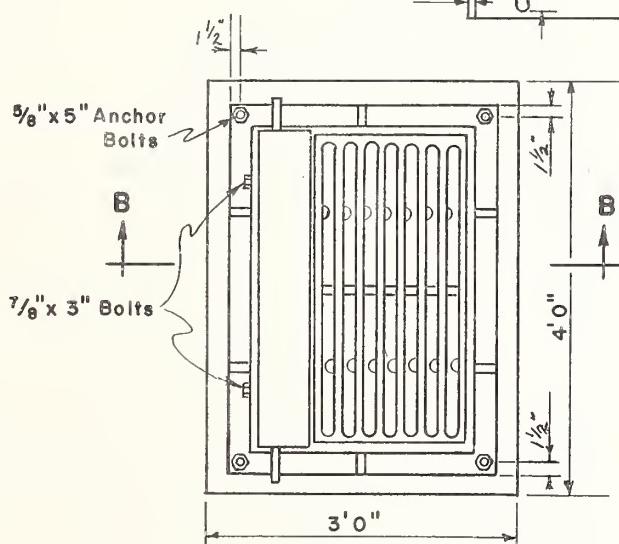
DETAIL 1



GRATE DETAILS



FRAME DETAILS



PLAN

NOTES

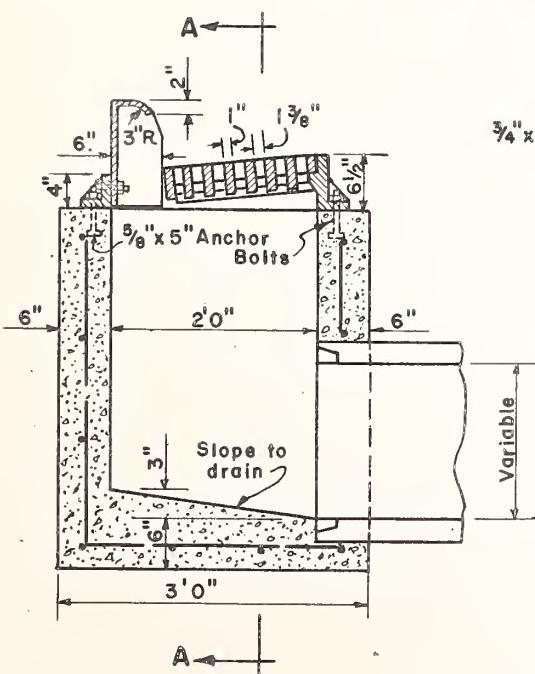
For curb heights greater than 8 inches curb box may be modified.

Curb and gutter to be warped to match drop inlet.

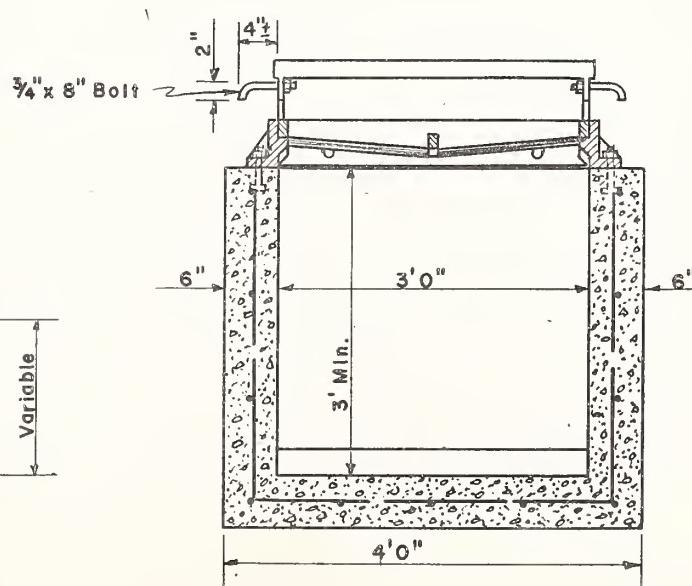
All concrete to be class "DD" OR EQUAL.

These details to serve as an example only. Designers will design to fit specific conditions. See plans for details and quantities. Use local standards where available.

After placement of curb box, the adjustment slots may be filled to supply bearing to bolts so to carry wheel loads, or bolt holes may be drilled in curb box after grades are established.



SECTION B-B



SECTION A-A

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REVISED
EFFECTIVE

1-1-64

1-30-67

6-1-69

1-1-64

1-1-64

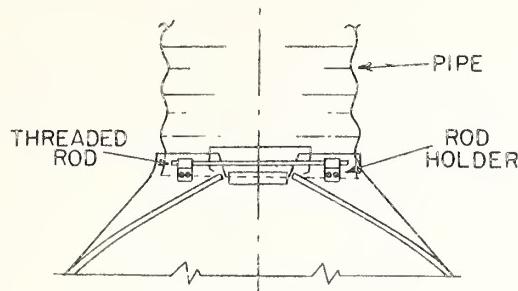
7-1-69

STANDARD DRAWING NO. 57-02

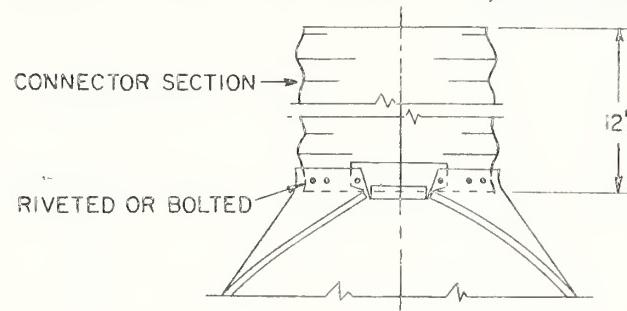
State Highway Commission
Helena, Montana

FLARED END TERMINAL SECTION
CORR METAL PIPE - ARCH CULVERT

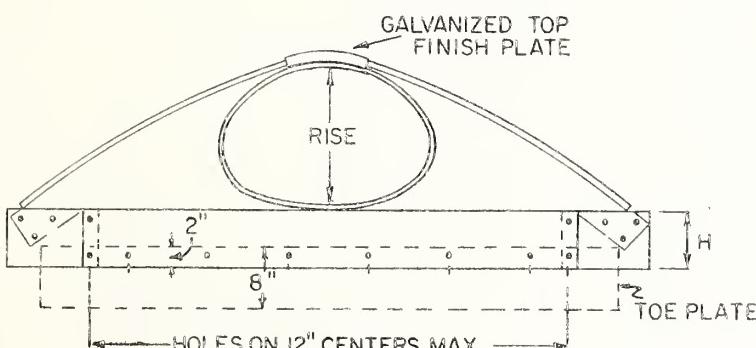
Approved
F. Smith, P.E., 12-9-68
of State Highway Engineer



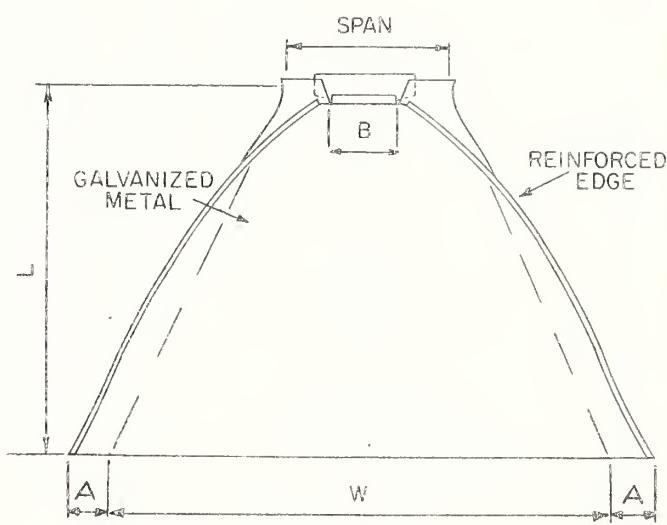
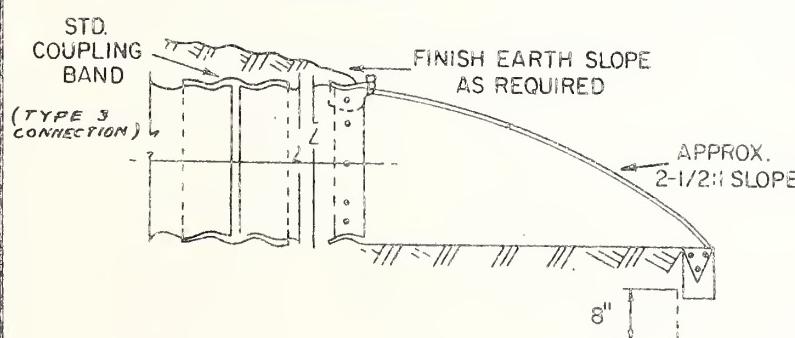
TYPE #2
STANDARD CONNECTION
FOR 18"X11" THRU 58"X36" ONLY



TYPE #3
STANDARD CONNECTION
FOR 65"X40" AND 72"X44"



ELEVATION



PLAN

PIPE-ARCH DIMENSION SPAN RISE	MIN. GA.	DIMENSIONS				
		A 1" Tol	B Max.	H 1" Tol	L 1½" Tol	W 2" Tol
18 11	16	7	9"	6"	19"	30"
22 13	16	7	10	6	23	36
25 16	16	8	12	6	28	42
29 18	16	9	14	6	32	48
36 22	14	10	16	6	39	60
43 27	14	12	18	8	46	75
50 31	12	13	21	9	53	85
58 36	12	18	26	12	63	90
65 40	12	18	30	12	70	102
72 44	12	18	33	12	77	114
79 49	12	18	36	12	77	126
85 54	12	18	36	12	77	138

Flared end terminal section to be included in length of pipe shown on plans.

All pores are to be galvanized in accordance with AASHO M 36.

Any areas where galvanizing is broken or metal is bare shall be pointed with one coat of red lead or zinc chromate prime and two coats of aluminum paint.

Minor variations in design will be acceptable, however the tolerances must not be exceeded. Seams or joints lengthwise of the apron will be acceptable if securely welded and painted as provided above.

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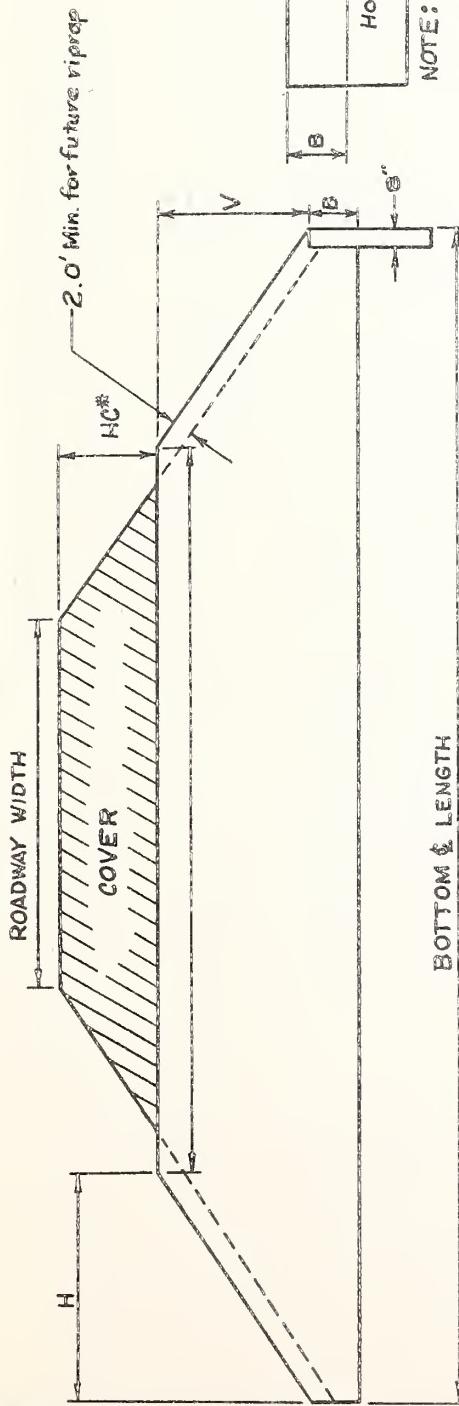
<u>REVISED</u>	8-1-67	11-20-68	5-20-69
<u>EFFECTIVE</u>	8-1-67	1-1-69	7-1-69

STANDARD DRAWING NO. 57-Q3

State Highway Commission
Helena, Montana

BEVEL ON CORRUGATED STEEL PIPE ARCH

Approved,
Lewis M. Shatto
of State Highway Engineer



NOTE: For details, see Standard Drawing # 74-04A
Covering Cutoff Walls.

Tolerance of $\pm 4\%$ will be allowed in all dimensions.

Use skew ends when skew is greater than 15° but not greater than 45° .

HC measured vertically from finished low shoulder to top of pipe. If possible it is desirable that top of pipe be placed 3 min. of 1.0' below subgrade surface.

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REVISED 6-16-67 11-20-68
EFFECTIVE 8-1-67 1-1-69

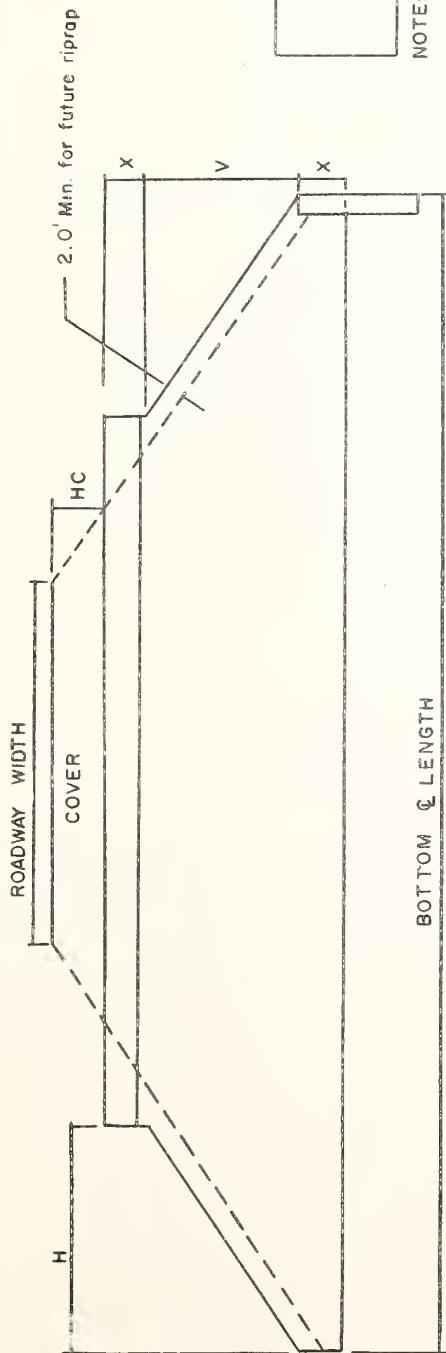
STANDARD DRAWING NO. 59-03

State Highway Commission

Helena, Montana

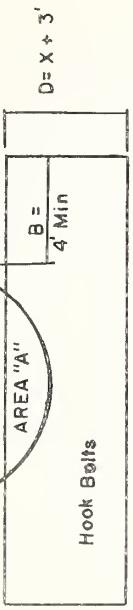
STEP BEVEL FOR CIRCULAR CSP & SSP

Approved
Lewis M. Shultz
State Highway Engineer



NOTE: See applicable Standard Drawing of Gage
Tables for Maximum & Minimum Height of Cover.

NOTE: For details, see Standard Drawing
covering Cutoff Walls



Dia (In.)	X^* (Ft.)	H in feet for bevels of:		Area 'A' Sq. Ft.	V* (Ft.)	H in feet for bevels of: 2:1		Area 'A' Sq. Ft.
		2:1	1.5:1					
48	1.000	3.000	2.000	2.46	1.38	2.875	8.625	11.500
54	1.125	3.375	4.500	2.250	1.44	3.000	9.000	12.000
60	1.250	3.750	5.000	2.500	1.50	3.125	9.375	12.500
66	1.375	4.125	5.500	2.750	1.56	3.250	9.750	13.000
72	1.500	4.500	6.000	3.000	1.62	3.375	10.125	13.500
78	1.625	4.875	6.500	3.250	1.68	3.500	10.500	14.000
84	1.750	5.250	7.000	3.500	1.74	3.625	10.875	14.500
90	1.875	5.625	7.500	3.750	1.80	3.750	11.250	15.000
96	2.000	6.000	8.000	4.000	1.92	4.000	12.000	16.000
102	2.125	6.375	8.500	4.250	1.98	4.125	12.375	16.500
108	2.250	6.750	9.000	4.500	2.04	4.250	12.750	17.000
114	2.375	7.125	9.500	4.750	2.10	4.375	13.125	17.500
120	2.500	7.500	10.000	5.000	2.16	4.500	13.500	18.000
126	2.625	7.875	10.500	5.250	16.98	2.28	4.750	14.250
132	2.750	8.250	11.000	5.500	18.50	2.40	5.000	15.000
				2.52	2.50	15.30	21.00	26.00
							10.300	6.77

Tolerance of $\pm 4\%$ will be allowed in all dimensions.
Use skew ends when skew is greater than 15° but not greater than 45° .
* For elliptical pipe, increase vertical dimensions by percent of ellipse.

REVISED 2-1-64 11-20-68
EFFECTIVE 2-1-64 1-1-69

STANDARD DRAWING NO. 65-01

State Highway Commission
Helena, Montana

GAGE TABLE FOR CORRUGATED ALUMINUM PIPE
H-20 LIVE LOAD

Approved
Lewis M. Gilbert 12-9-68
State Highway Engineer

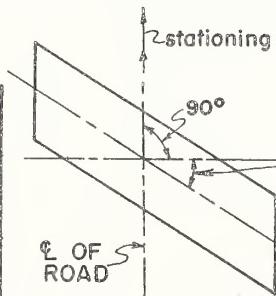
GAGES OF NOT ELONGATED CORRUGATED ALUMINUM PIPE CULVERTS											
Area Sq. Ft.	Dia. Inches	Height of Cover Above Top of Culvert (Feet)									
		1-10	11-15	16-20	21-25	26-30	31-35	36-40	—	—	—
1.2	15	0.060	0.060	0.060	0.060	0.060	0.075	0.105	—	—	—
1.8	18	0.060	0.060	0.060	0.060	0.075	0.105	—	—	—	—
2.4	21	0.060	0.060	0.060	0.075	0.105	0.135	—	—	—	—
3.1	24	0.075	0.075	0.075	0.075	0.105	0.135	—	—	—	—
4.9	30	0.075	0.075	0.075	0.105	0.135	0.164	—	—	—	—
7.1	36	0.105	0.105	0.105	0.135	0.164	—	—	—	—	—
9.6	42	0.105	0.105	0.135	0.164	0.164	—	—	—	—	—
For Lengthening Culverts in Place											
USE ELONGATED PIPE											

Thickness Inches	Gage (Approx.)
0.060	16
0.075	14
0.105	12
0.135	10
0.164	8

GAGES OF ELONGATED CORRUGATED ALUMINUM PIPE CULVERTS											
Area Sq. Ft.	Dia. Inches	Height of Cover Above Top of Culvert (Feet)									
		1-10	11-15	16-20	21-25	26-30	—	—	—	—	—
12.6	48	0.105	0.105	0.105	0.135	0.164	—	—	—	—	—
15.9	54	0.105	0.105	0.105	0.135	0.164	—	—	—	—	—
19.6	60	0.135	0.135	0.164	0.164	—	—	—	—	—	—
23.8	66	0.135	0.135	0.164	—	—	—	—	—	—	—
28.3	72	0.135	0.135	0.164	—	—	—	—	—	—	—

GAGES OF CORRUGATED ALUMINUM PIPE-ARCH CULVERTS											
Area Sq. Ft.	Span Inches	Rise Inches		Dia. of Pipe of Eq. Per.	Height of Cover (Feet)			2-9	9-12	12-16	
					2-9	9-12	12-16				
1.1	18	11		15	0.060	0.060	0.060				
1.6	22	13		18	0.060	0.060	0.060				
2.2	25	16		21	0.060	0.060	0.060				
2.8	29	18		24	0.075	0.075	0.075				
4.4	36	22		30	0.075	0.105	0.105				
6.4	43	27		36	0.105	0.105	0.105				
8.7	50	31		42	0.105	0.105	0.135				
11.4	58	36		48	0.105	0.135	0.135				
14.3	65	40		54	0.105	0.135	0.164				
17.6	72	44		60	0.135	0.164	—				

Note: All dimensions are in inches, except fill height.



NOTE: SKEW RIGHT SHOWN.
ANGLE OF SKEW DEGREES TO LEFT AND RIGHT.
CUT END OF CULVERT PARALLEL TO C OF ROAD WHEN SPECIFIED.

NOTE: WHEN SKEW ANGLE EXCEEDS 20° AND THE PIPE ARCH HAS THE ENDS CUT TO FIT A SLOPE, ENDS SHALL BE REINFORCED WITH MASONRY.

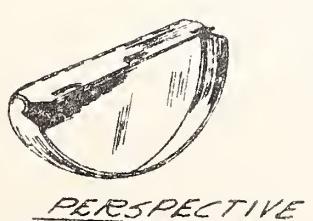
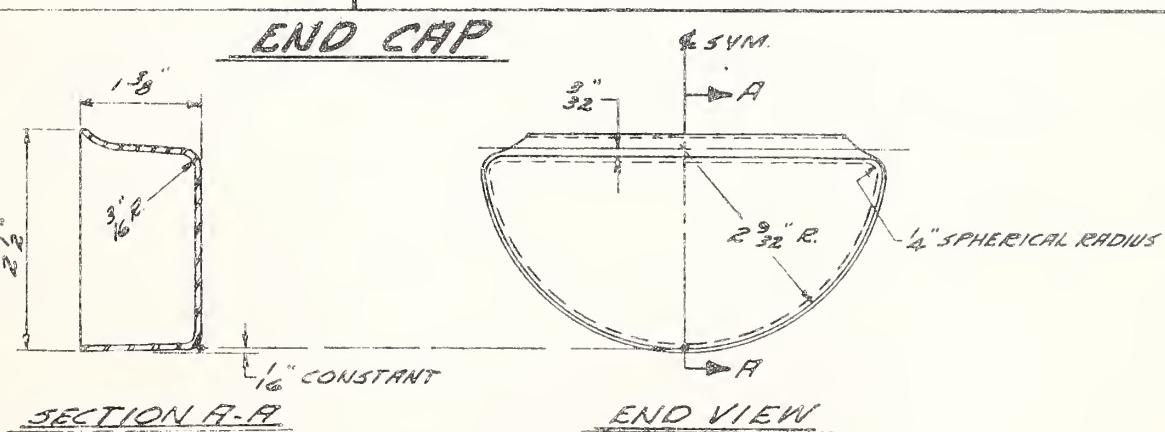
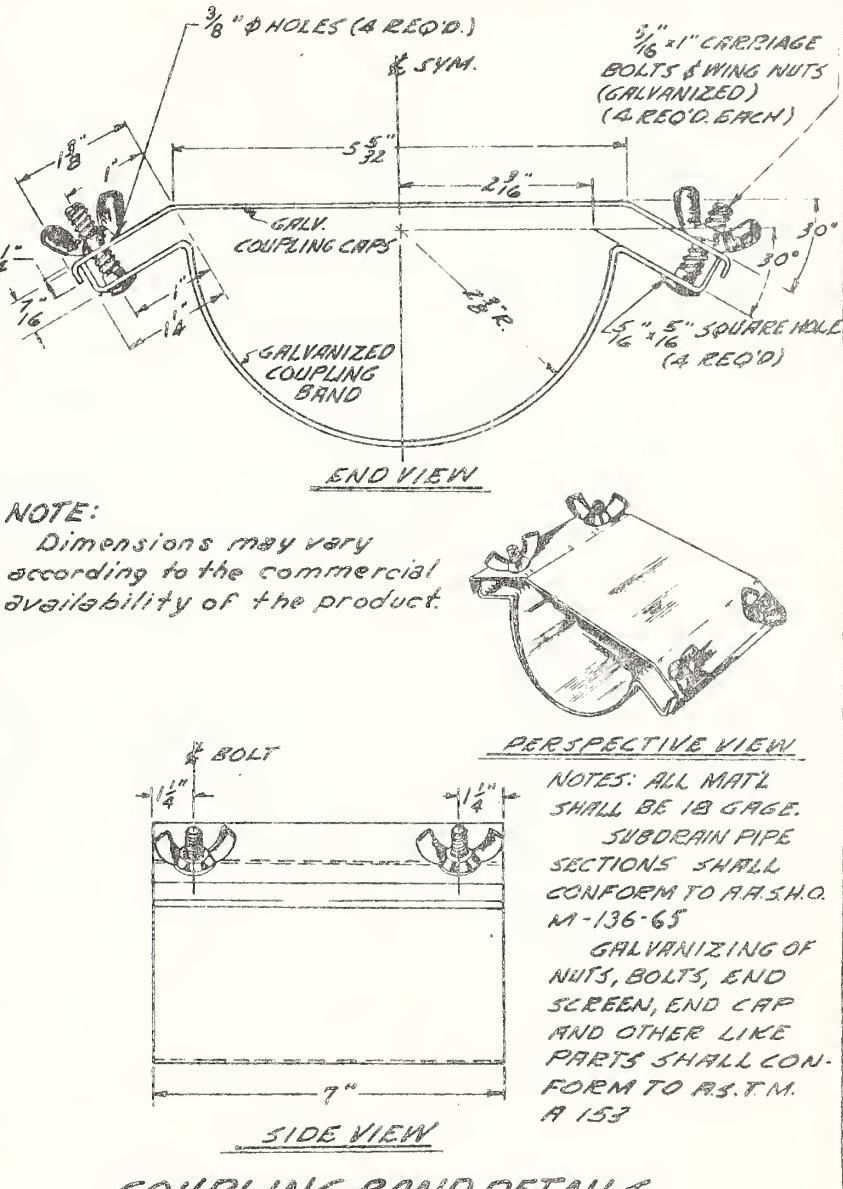
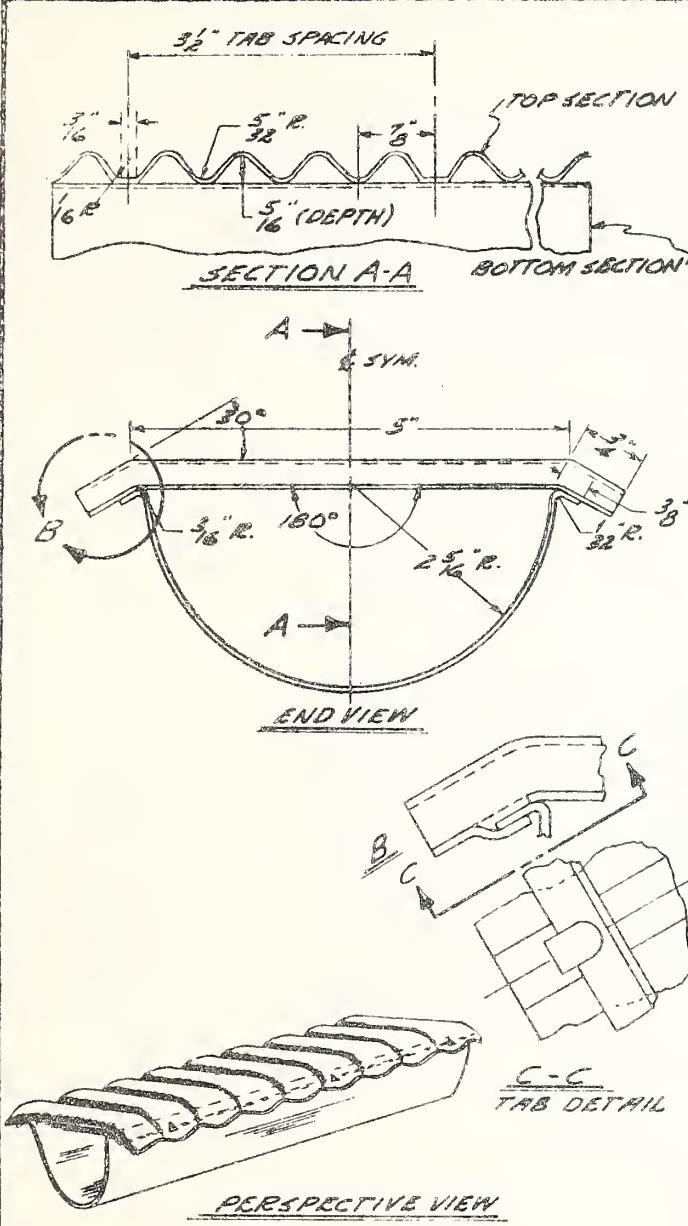
REVISED EFFECTIVE	8-1-63	11-20-68	5-21-69
	8-1-63	1-1-69	7-1-69

STANDARD DRAWING NO. 69-01

State Highway Commission
Helena, Montana

SEMICIRCULAR UNDERDRAIN

Approved

Lew M. Pittay 12-9-69
State Highway Engineer

NOTES:

MATERIAL TO BE 18 GAGE COPPER BEARING GALVANIZED STEEL.
END OF CAP TO FIT SNUG, WHEN INSERTED INSIDE END OF UNDERDRAIN.
TOLERANCES ARE $\pm \frac{1}{16}$ " EXCEPT AS SHOWN.
 $\frac{1}{2}$ " GALV. MESH SCREEN, SHAPED LIKE THE CAP, TO BE PROVIDED FOR EACH PIPE OUTLET.

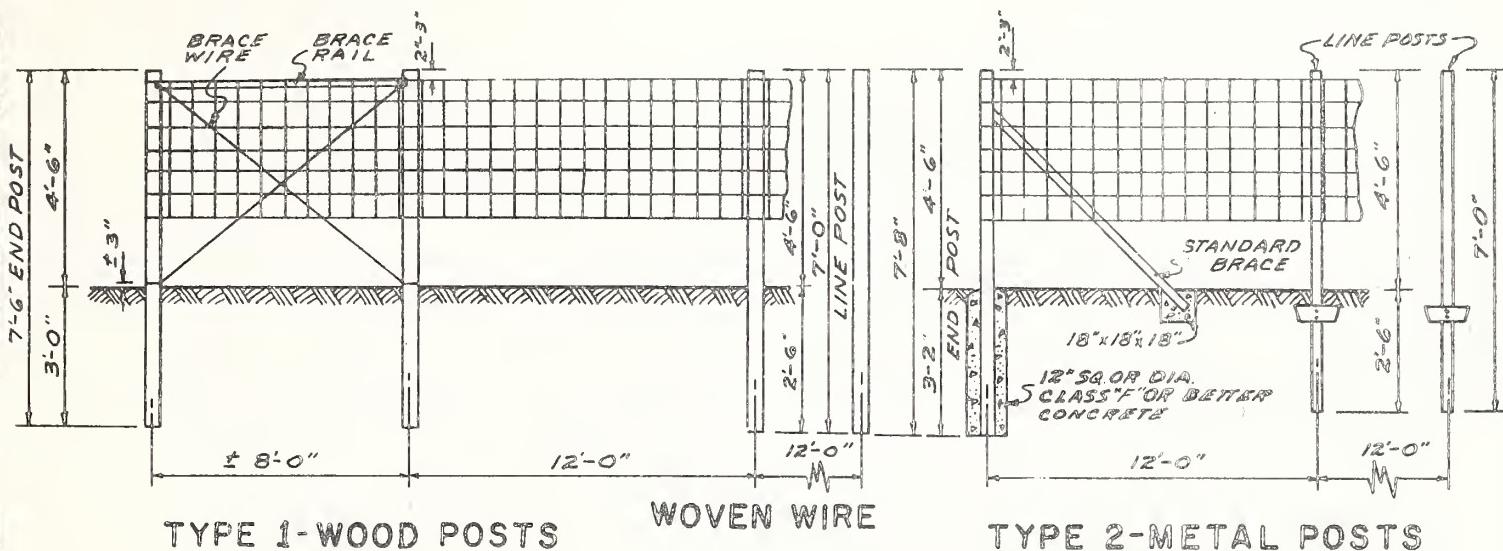
REVISED 5-1-63 11-1-68
EFFECTIVE 5-1-63 11-1-69

STANDARD DRAWING NO. 80-02

State Highway Commission
Helena, Montana

MEDIAN BARRIER FENCE

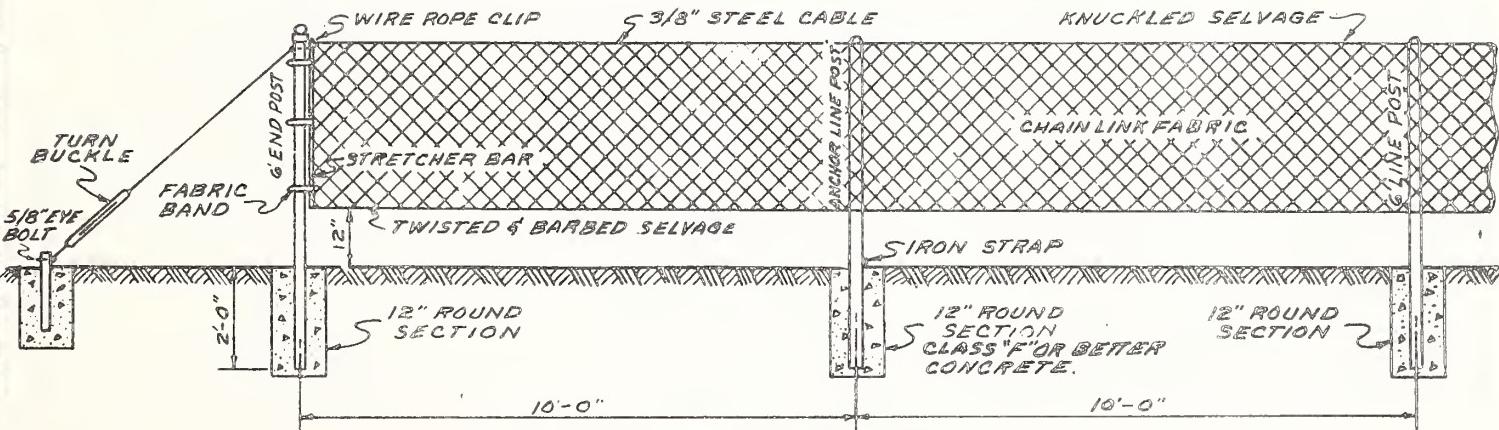
Approved
James M. Phillips 10-29-68
State Highway Engineer



TYPE 1-WOOD POSTS

WOVEN WIRE

TYPE 2-METAL POSTS



TYPE 3-CHAIN LINK

WOVEN WIRE MEDIAN BARRIER FENCE

WOVEN WIRE-DESIGN 832 - ARTICLE 81.12
BRACE WIRE - PART (D) - ARTICLE 81.12
WOOD POSTS - PART (I) - ARTICLE 81.12
METAL POSTS- PART (H) - ARTICLE 81.12
DEADMAN --- PART (L) - ARTICLE 81.12
CONCRETE MATERIALS TO CONFORM TO STD. SPEC.
CONSTRUCTION IN ACCORDANCE WITH STD. SPEC.
PROPOSAL ITEM NUMBERS:
8071 TYPE 1 MEDIAN BARRIER FENCE - ROD
8072 TYPE 2 MEDIAN BARRIER FENCE - ROD

METAL POST SPACING SAME AS WOOD.
SET END POST IN CONCRETE
METAL LINE POSTS TO HAVE STANDARD ANCHOR PLATE
END POSTS TO BE ANGLE STEEL 2 $\frac{1}{2}$ "x2 $\frac{1}{2}$ "x $\frac{1}{2}$ "

CHAIN LINK MEDIAN BARRIER FENCE

WHEN CHAIN LINK MEDIAN BARRIER FENCE IS SPECIFIED:
REFER TO STANDARD SPECIFICATIONS, FOR
MATERIALS AND CONSTRUCTION
CHAIN LINK FABRIC TO BE GALVANIZED STEEL
TOP RAIL OR CABLE SHALL NOT BE USED,
TOP AND BOTTOM OF WIRE MESH SHALL BE KNUCKLED SELVAGE.

GENERAL NOTES

MAXIMUM SPACING BETWEEN PANELS AND/OR PULL POSTS
SHALL BE APPROXIMATELY 400 FEET ON TYPES 1, 2
AND 3 MEDIAN BARRIER FENCE (LESS IF DIRECTED BY
ENGINEER OR SO SPECIFIED).

SEE STANDARD DRAWING NO. 81-02 FOR OTHER DETAILS
AND FOR DEADMAN.

REVISED 10-5-66 11-22-68
EFFECTIVE 2-1-67 1-1-69

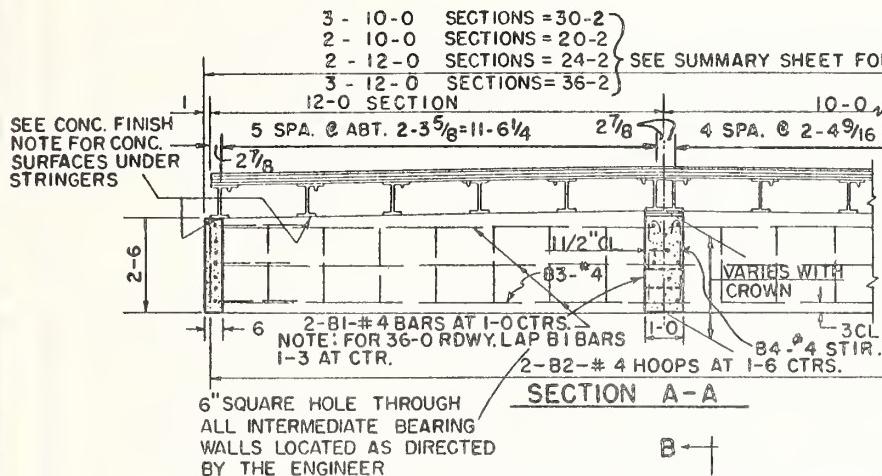
STANDARD DRAWING NO. 82-01

State Highway Commission
Helena, Montana

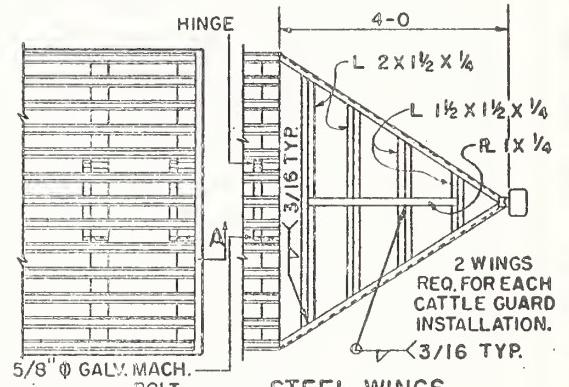
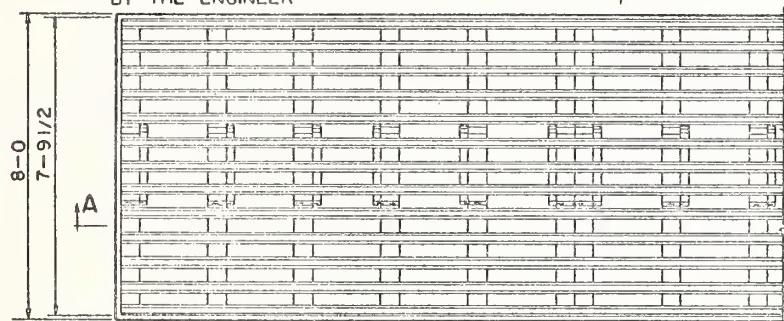
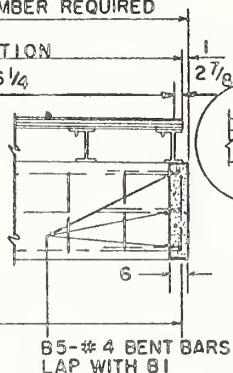
CATTLE GUARD

Approved
Loring Clapp 10-24-68
State Highway Engineer

LIVE LOADING: STANDARD (H20) LOADING



1-1/2" Ø X 6" LAG SCREW
1/4" CONNECTION PLATE WELD TO
2X1 1/2 ANGLES WITH 3/16 FILLET
WELD ALL AROUND.



PLAN

*NOTE: THIS DIMENSION WILL VARY.
SEE APPROVED DWG. FOR
PROJECT BEFORE SETTING
8-0 ANY FOOTING GRADES.

12 SPACES AT 0-7 1/2 CTRS. = 7-6

5/8" Ø GALV. MACH. BOLTS HINGE
(SEE DETAIL)

TOP OF CONC. 10' W 21 # 1"

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Drawn 3-1-66

Revised 11-1-68

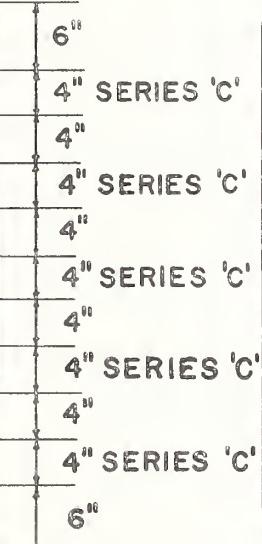
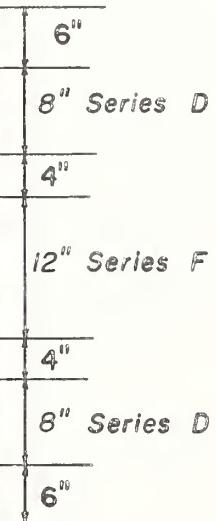
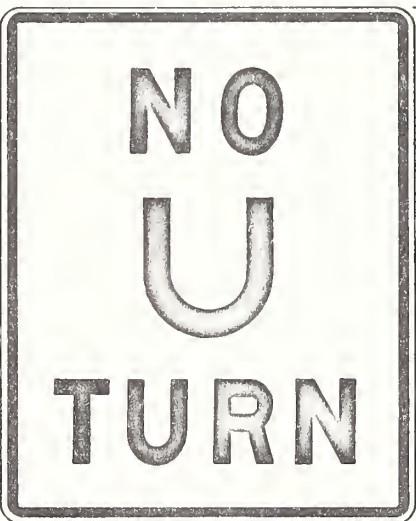
Effective 1-1-69

STANDARD DRAWING NO. 88-09

State Highway Commission
Helena, Montana

SIGNING OF MEDIAN U-TURNS

Approved

Luis J. Gutierrez 12-15-67
State Highway EngineerR3-10
36 x 48R3-4 (OPTIONAL)
36 x 48

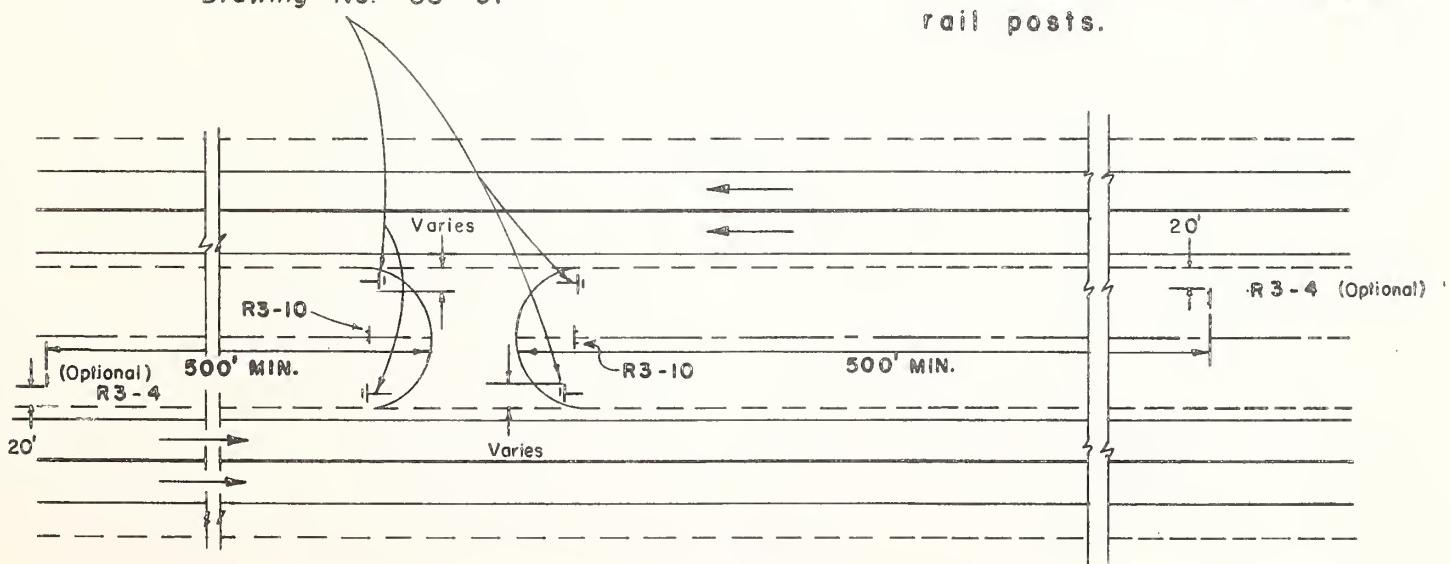
Margin = $\frac{5}{8}$ "
 Border = $\frac{7}{8}$ "
 Corner Radius = 2"

NOTES:

R3-4 and R3-10 shall have black legend on white reflectorized background.

Sign posts for median opening through median guard rail shall be placed in line with guard rail posts.

Steel guide post with design 'B' delineator as specified in Standard Drawing No. 88-91



U-TURN MEDIAN OPENINGS
(See Std. Dwg. 20-05)

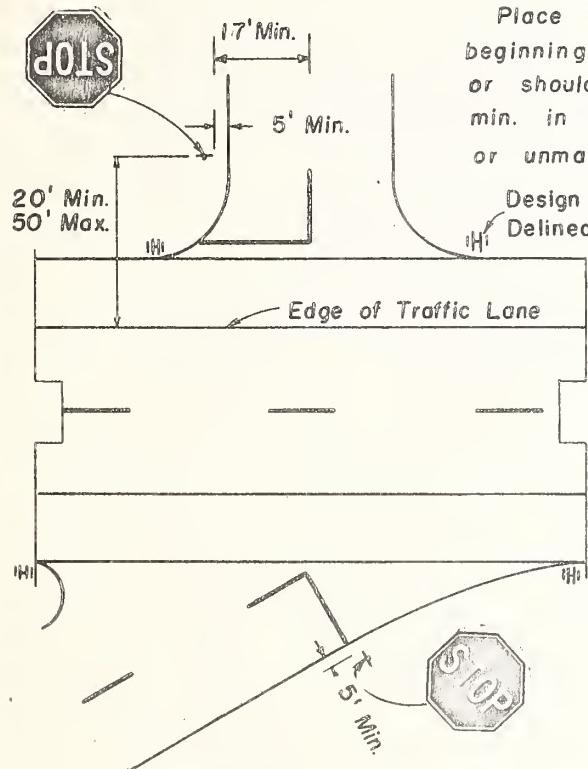
Drawn 6-1-65

Revised 1-1-68
Effective 2-1-68

STANDARD DRAWING NO. 88-56

State Highway Commission
Helena, Montana

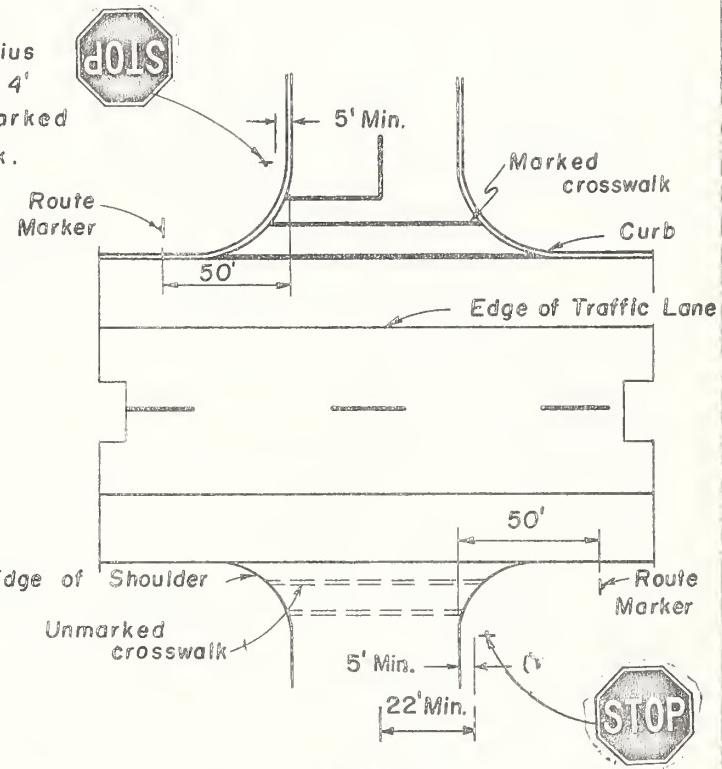
TYPICAL APPROACH ROAD SIGNING

Approved
Loring Phillips #1562
State Highway Engineer

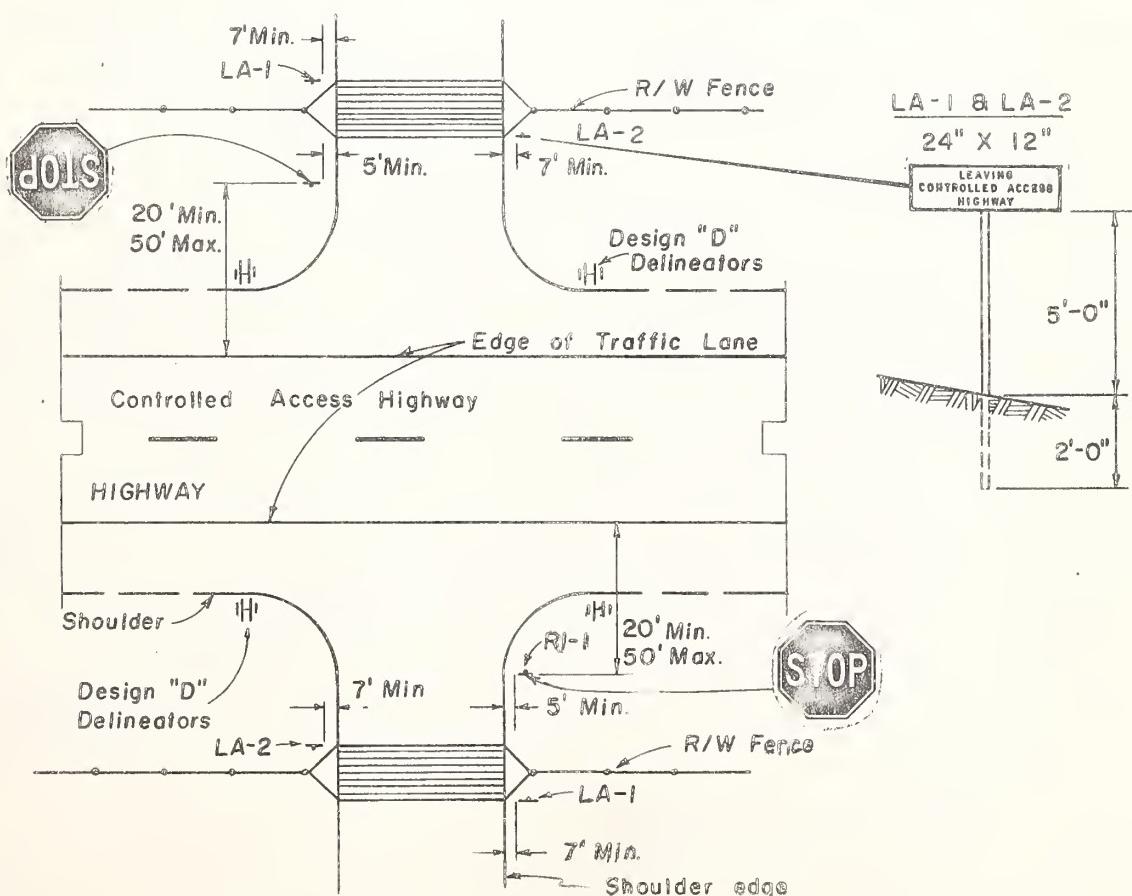
RURAL

Place Stop Sign at
beginning of curb radius
or shoulder radius or 4'
min. in advance of marked
or unmarked crosswalk.

Design "D"
Delineators



URBAN



CONTROLLED ACCESS

DRAWN 3-1-67
EFFECTIVE 6-1-67

Revised 11-68
Effective 2-1-68

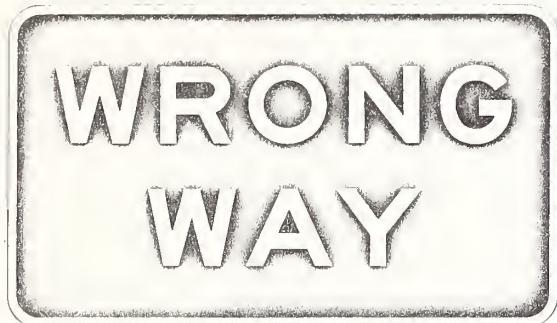
STANDARD DRAWING NO. 88-58

State Highway Commission
Helena, Montana

TYPICAL CROSSROAD & RAMP LAYOUT

Approved
Geo. W. Chiles, State Highway Engineer

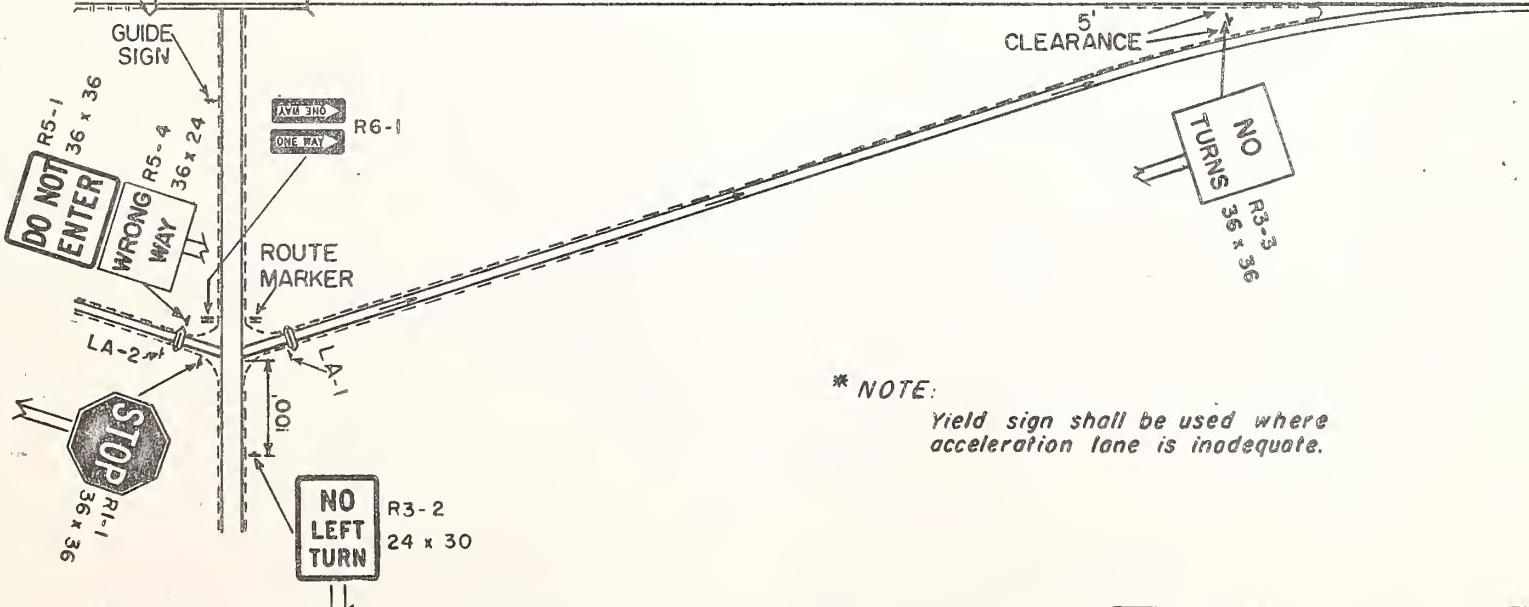
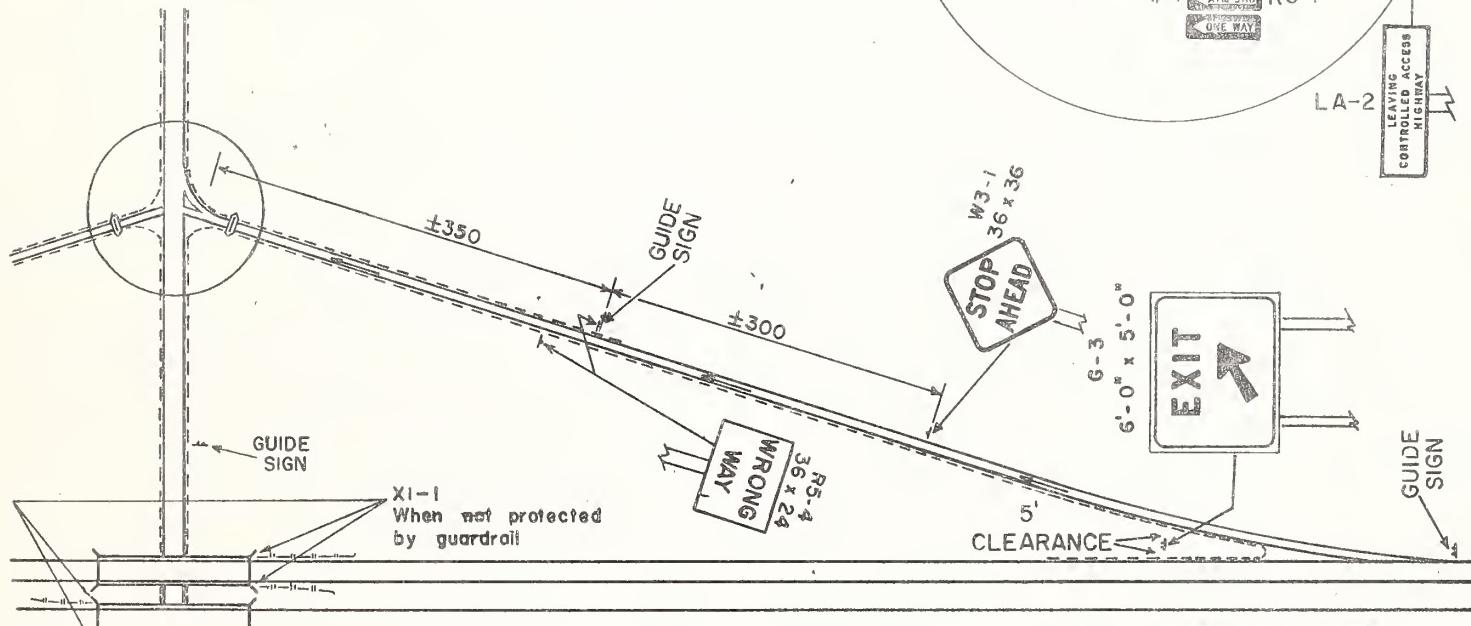
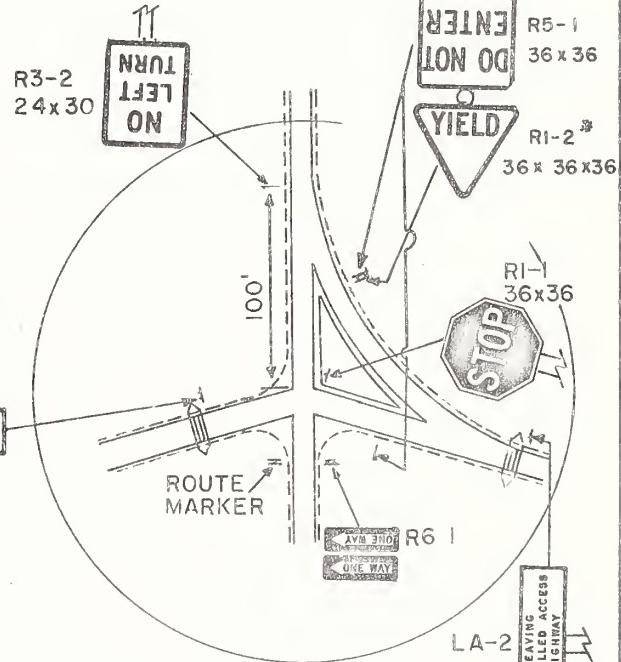
R5-4
36" x 24"



5" Margin
2" Corner Radius

White legend on red reflectorized
background

5"
5"
Series F
4"
5"
Series F
5"



* NOTE:

Yield sign shall be used where
acceleration lane is inadequate.

DRAWN - 1-1-68
EFFECTIVE 1-1-68

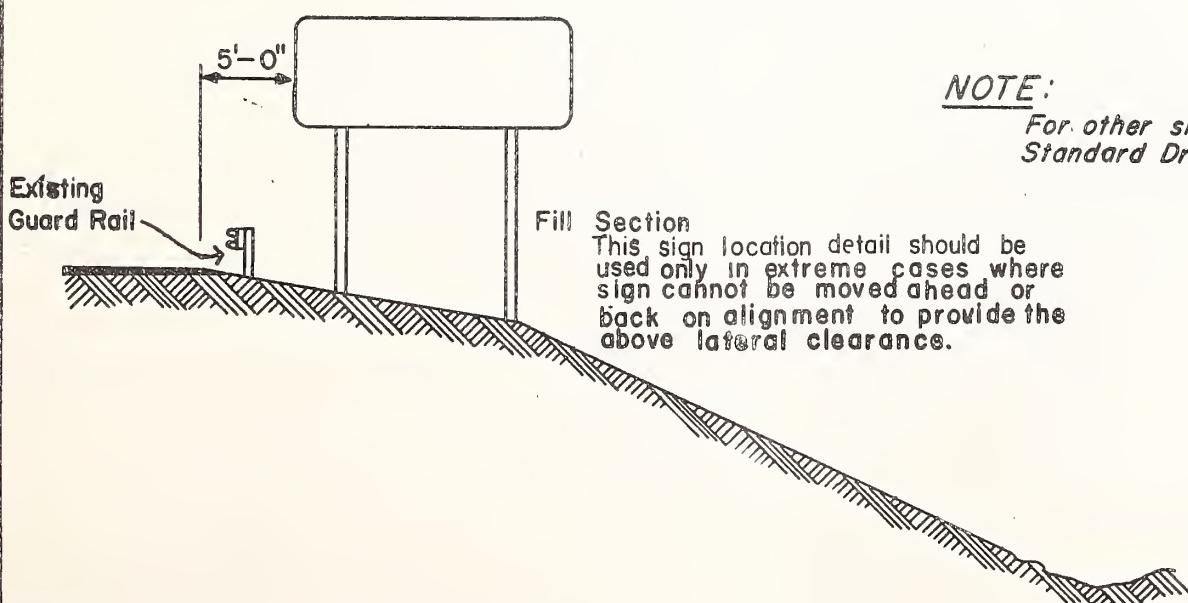
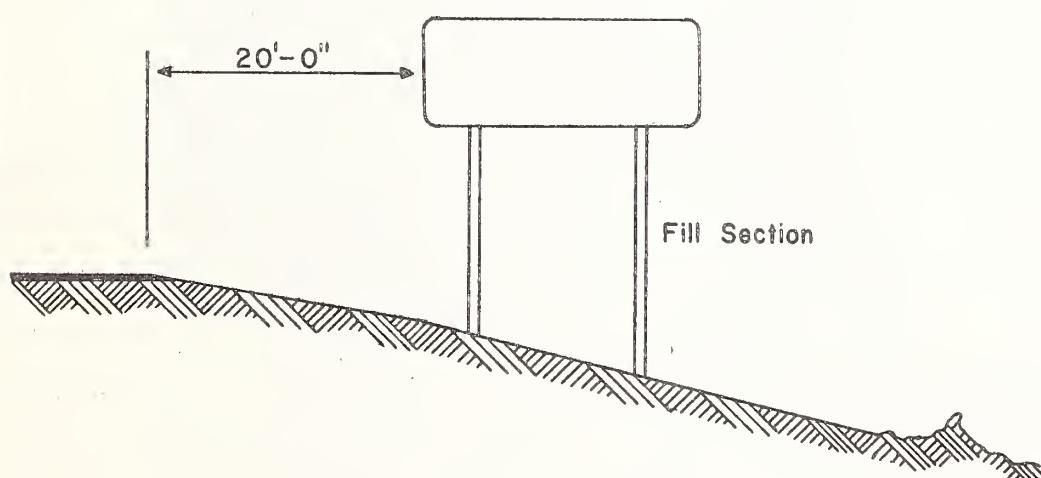
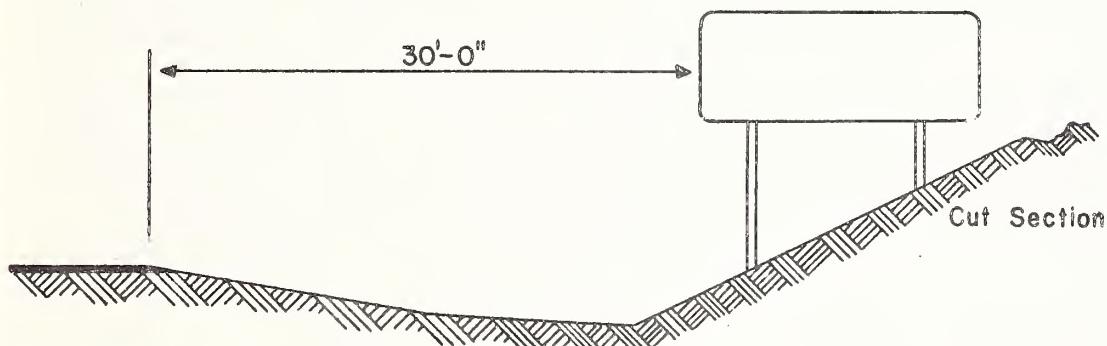
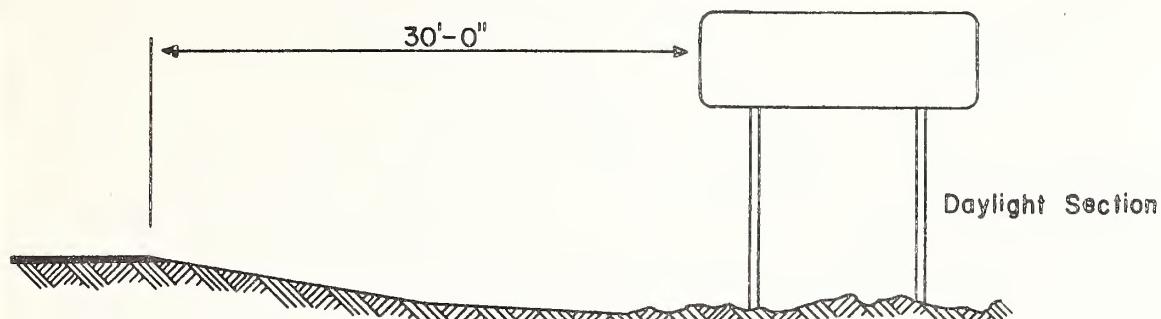
Revised 11-1-68
Effective 1-1-69

STANDARD DRAWING NO. 88-59

State Highway Commission
Helena, Montana

TYPICAL GUIDE SIGN PLACEMENT

Approved
January 1968
State Highway Engineer



NOTE:

For other sign specifications see
Standard Drawing No. 88-67

Drawn 3-1-63

REVISED 3-1-66
EFFECTIVE 3-1-66

STANDARD DRAWING NO. 88-74

State Highway Commission
Helena, Montana

X1-1 SIGN & ERECTION DETAIL

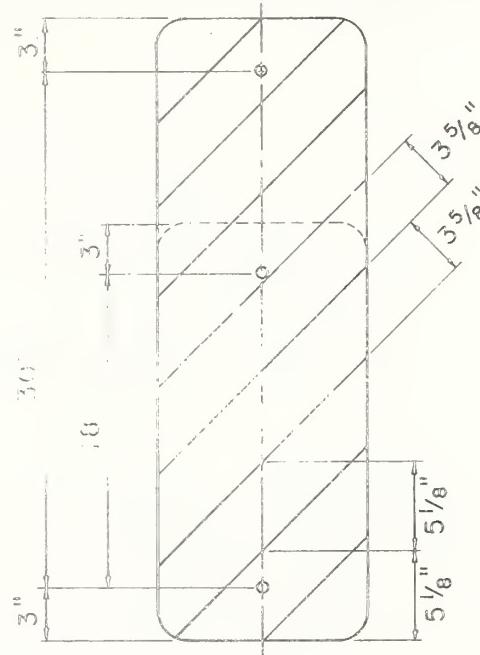
Approved

Louis C. Buttler 1-4-68
State Highway Engineer

12" X 24"

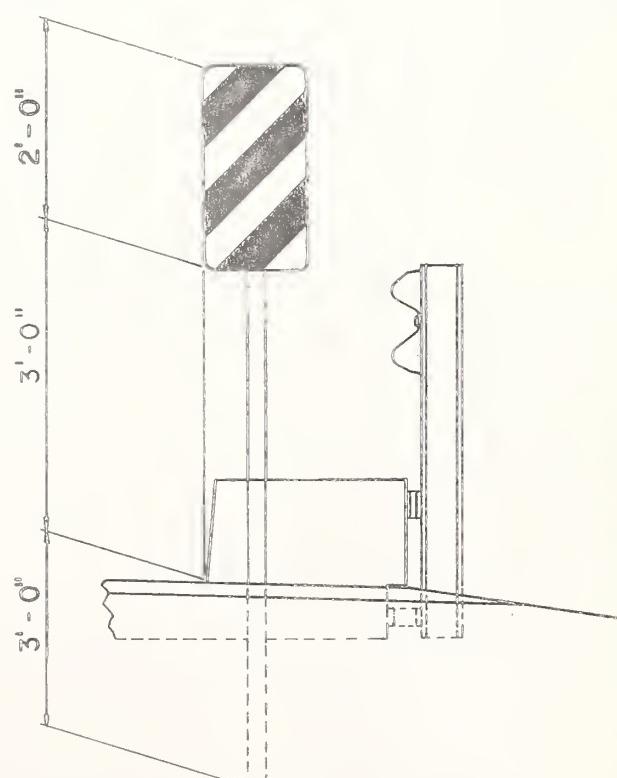
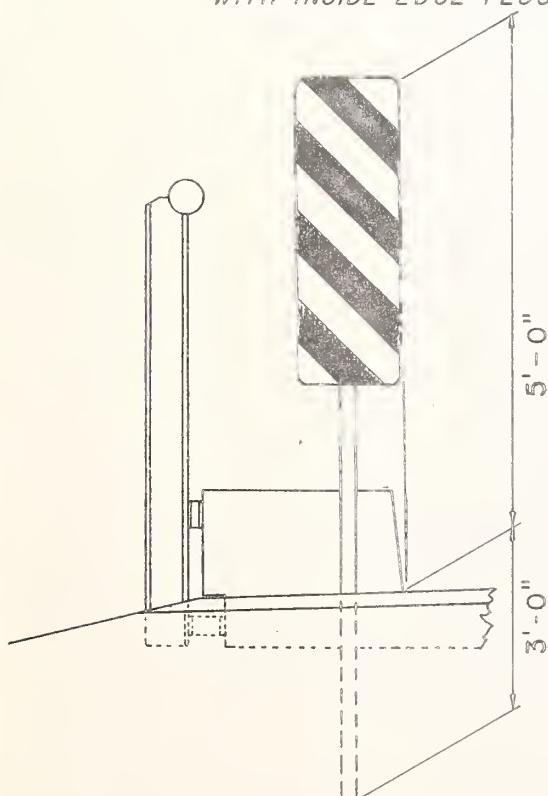


12" X 36"



NOTE:

STRIPES SHALL BE BLACK AND REFLECTORIZED WHITE.

PANELS SHALL BE MOUNTED ON STEEL U POSTS, 2 LBS./FT.,
WITH INSIDE EDGE FLUSH WITH FACE OF CURB.

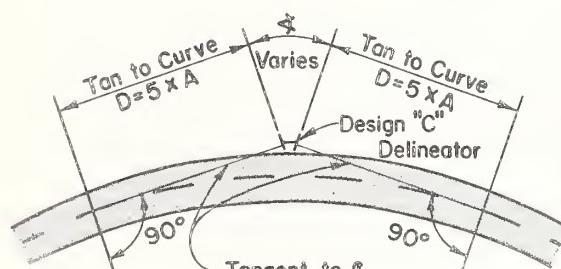
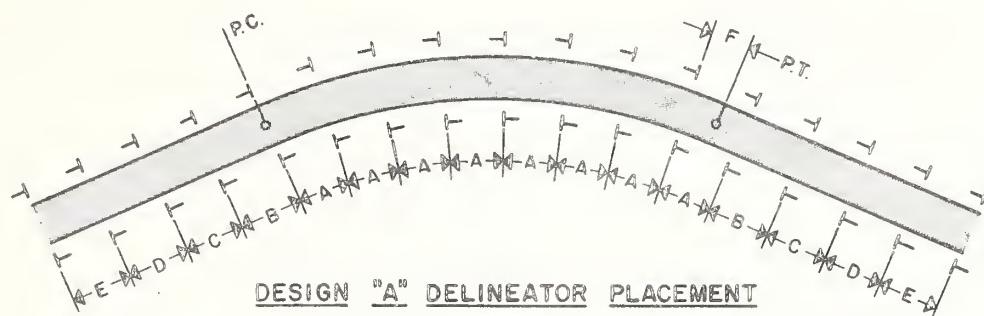
Drawn 5-1-65

REVISED 11-1-68
EFFECTIVE 1-1-69

STANDARD DRAWING NO. 88-92,

State Highway Commission
Helena, MontanaDELINEATOR SPACING FOR
HORIZONTAL HIGHWAY CURVES

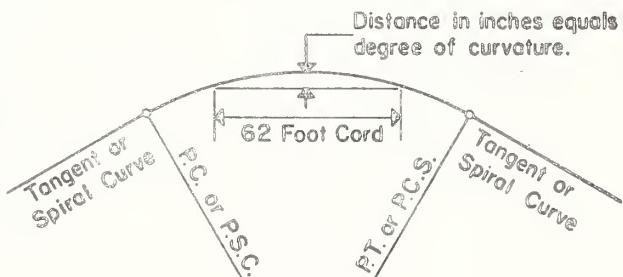
Approved

James G. Gilligan P.E.
State Highway Engineer

Place Design "C" Delineators on curves sharper than $7^{\circ} 30'$. Position delineator faces perpendicular to center line of curve as shown. Spacing shall be as called for in Table below.

DEGREE OF CURVE	SPACING "A" ON CURVE	SPACING ON BOTH APPROACHES			
		B	C	D	E
0° TO 30'	200'	264'	264'	264'	264'
30° TO 1°	175'	264'	264'	264'	264'
1° TO 2°	125'	225'	264'	264'	264'
2° TO 3°	95'	170'	264'	264'	264'
3° TO 4°	80'	145'	240'	264'	264'
4° TO 6°	70'	125'	210'	264'	264'
6° TO 8°	55'	100'	165'	264'	264'
8° TO 12°	45'	80'	135'	264'	264'
12° TO 20°	35'	65'	175'	210'	264'
20° PLUS	25'	45'	75'	150'	284'

FIELD METHOD FOR DETERMINING DEGREE OF HORIZONTAL CURVES



NOTES:

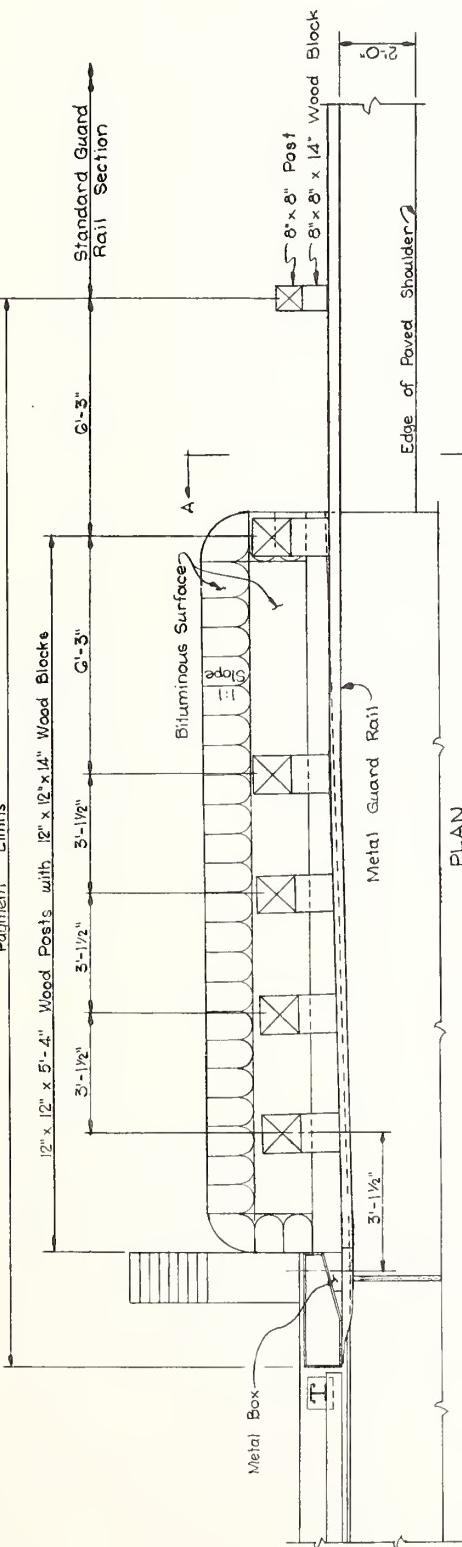
1. If distance F is 20 feet or more, add one regular "A" space as called for in the above table.
2. See Standard Drawing No. 88-91 for Delineator Design Details.
3. Post with delineators shall be placed on the right hand side facing oncoming traffic, 2'-0" clear from edge of shoulder or the face of curb, or as shown on the plans.
4. Delineator button shall be a nominal 3" diameter reflector as specified by Standard Specifications.
5. Delineator spacing on Tangent, shall be 264', unless otherwise noted on project plans.
6. Interstate highways shall be continuously delineated.
7. Posts shall be installed behind guard rail posts where there is guard rail installed along the highway.
8. Where, under normal spacing, a delineator post falls within a crossroad, that post may be moved in either direction a distance not to exceed one quarter of the normal spacing.
9. Primary & secondary highways may be continuously delineated in areas where ground blizzards are prevalent or in areas of hazardous alignment; otherwise, curves of 4° and sharper shall be delineated on the outside of the curve. Where vertical alignment is rolling, horizontal curves less than 4° may require delineation.

DRAWN - 7-1-69 REVISED
EFFECTIVE - 7-1-70
STATE HIGHWAY
COMMISSION
Helena, Montana

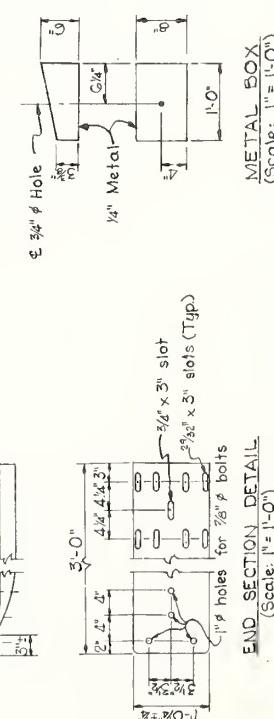
APPROVED:
James S. Bellon, P.E.
STATE HIGHWAY ENGINEER

STANDARD DRAWING NO. 90-18
FLEX BEAM GUARD RAIL BRIDGE APPROACH

Payment Limits

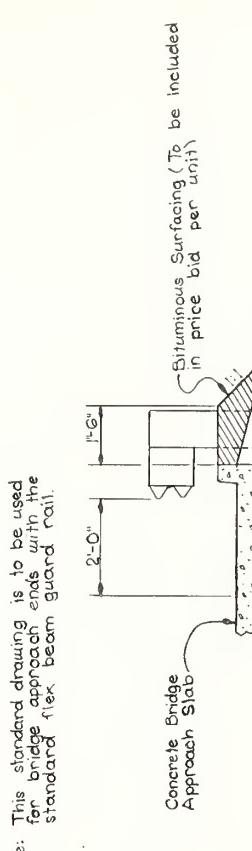


PLAN



END SECTION DETAIL
(Scale: 1' = 1'-0")

METAL BOX
(Scale: 1' = 1'-0")



Concrete Bridge Approach Slab

Biluminous Surfacing (To be included in price bid per unit)

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REVISED 5-1-64 11-1-68
EFFECTIVE 5-1-64 1-1-69

STANDARD DRAWING NO. 96-01

State Highway Commission
Helena, Montana

MONUMENTS & MARKERS

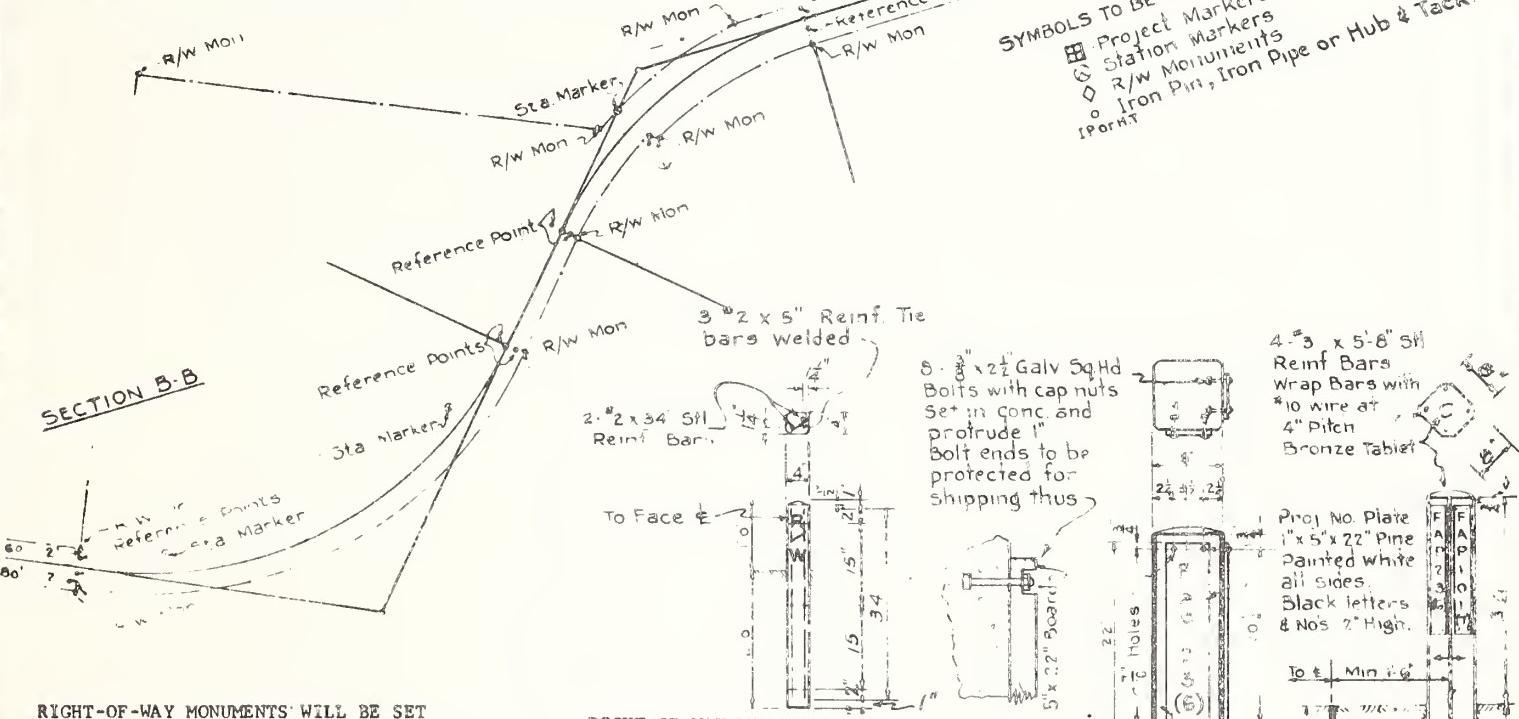
Approved

Lewis M. Phillips 10-24-68
State Highway Engineer

GENERAL: REFERENCE POINTS, PROJECT AND STATION MARKERS SHOULD BE SO PLACED THAT THEY WILL NOT BE DISTURBED BY MAINTENANCE OPERATIONS. PROJECT AND STATION MARKERS SHOULD BE PLAINLY VISIBLE FROM THE HIGHWAY.

RIGHT-OF-WAY MONUMENTS NOT TO BE ORDERED BY CONTRACTOR UNTIL CHECKED IN FIELD BY THE ENGINEER.

RIGHT-OF-WAY MONUMENTS TO BE PLACED SO THAT OUTSIDE FACE OF MONUMENT COINCIDES WITH RIGHT-OF-WAY LINE.

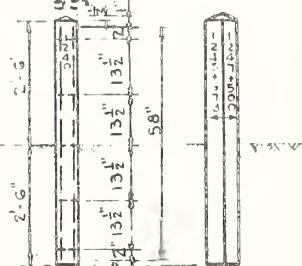


RIGHT-OF-WAY MONUMENTS WILL BE SET AT ALL POINTS WHERE THE WIDTH OF THE RIGHT-OF-WAY CHANGES AND AT PCS, PTS AND AT ANGLE POINTS. WHEN IT SEEMS UNDESIRABLE TO USE THE CONCRETE MONUMENTS, AS ON LOT OR BLOCK LINES IN SOME PARTS OF A TOWN, CONCRETE MONUMENTS WILL BE OMITTED AND IRON PIPES OR PINS WILL BE PLACED BY STATE HIGHWAY COMMISSION FORCES.

RIGHT-OF-WAY MONUMENT

CONCRETE:
RUBBED FINISH ON FACE. 4"X4" SQUARE.
RECESSED LETTERS 3" HIGH;
CORNERS CHAMFERED 1/2".

3 #2 x 5" Reinf. Tie bars welded
2-#2 x 34 Stl. Reinf. Bar



STATION MARKERS

STATION MARKERS ARE TO BE SET OPPOSITE EVERY TENTH STATION AND AT IMPORTANT EQUATIONS. EQUATIONS OF LESS THAN 100' MAY BE DISREGARDED. MARKERS ARE TO BE SET ON THE NORTH OR WEST SIDE OF THE CENTERLINE DEPENDING ON THE GENERAL DIRECTION OF THE ROUTE OR SHALL BE SET SO AS TO BE VISIBLE FROM THE HIGHWAY CENTERLINE (ON R/W LINE IF POSSIBLE).

CONCRETE:
RUBBED FINISH ON FACE.
RECESSED LETTERS 3" HIGH
EXCEPT EQUATIONS WHICH
WILL BE 1 1/2" HIGH.
CORNERS CHAMFERED 1/2".

PROJECT MARKER POSTS TO BE REINFORCED CONCRETE.

CORNERS
CHAMFERED 1/2". PROJECT NUMBER PLATE TO BE FURNISHED AND ERECTED BY STATE FORCES. SERIES "D" LETTERS AND NUMERALS TO BE USED AS PER STANDARD ALPHABETS PUBLISHED BY BUREAU OF PUBLIC ROADS, 1945.

REFERENCE POINT

1" IRON PIN.
ANOTHER REFERENCE POINT TO BE SET ON OPPOSITE SIDE OF HIGHWAY.

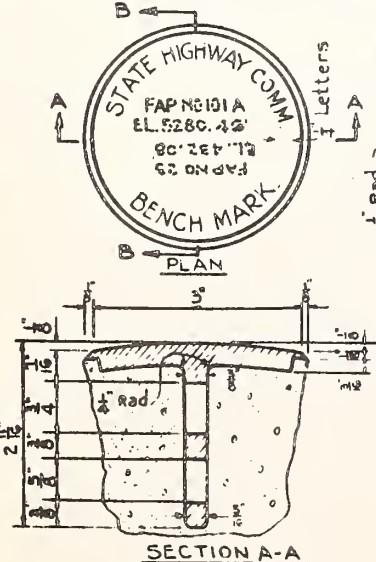
PROJECT MARKERS ARE TO BE SET AT THE BEGINNING AND END OF ALL PROJECTS ON EITHER SIDE OF THE HIGHWAY.

REFERENCE POINTS ARE TO BE SET ON BOTH SIDES OF THE CENTERLINE AT THE BEGINNING AND END OF ALL PROJECTS, AT ALL PCS, PTS AND ANGLE POINTS AND AT SUCH HIGH POINTS ON LONG TANGENTS AS MAY BE DESIRABLE. EXCEPT AT / PROJECT MARKERS, THEY ARE TO BE AT ANY CONVENIENT DISTANCE FROM THE CENTERLINE.

ALL CONCRETE SHALL BE CLASS "DD" OR EQUAL.

BRONZE TABLET

To be set in top of project marker



BRONZE TABLET

EXPOSED SURFACES OF THE TABLET ARE TO BE GROUND SMOOTH. LETTERS ARE TO BE RECESSED 1/16". INFORMATION ON THE TABLET, INDICATED BY PIN LINES, IS TO BE STAMPED IN THE FIELD BY THE ENGINEERING PARTY AFTER POST IS PLACED, USING 3/16" LETTERS.

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STATE HIGHWAY COMMISSION
HELENA, MONTANA 59601

January 1, 1970

STANDARD DRAWING BOOK

We are sending the following additions and/or revisions effective January 1, 1970, to be included in your present Standard Drawing Book, the grey covered one, original issue January 1, 1969.

- 11-04 Roadway Embankment at Bridge Ends.
- 39-14 Standard Concrete Approach Slabs to Structures.
- 39-15 Standard Concrete Approach Slabs to Structures With U Type Abutments.
- 50-01 Culvert Riprap.
- 54-03 Bedding Material.
- 56-01 Thickness for Corrugated Steel Pipe 2 2/3 x 1/2 Corrugation - H2O Loading.
- 56-02 Thickness for Corrugated Steel Pipe 3 x 1 Corrugation - H2O Loading.
- 56-03 Thickness for Corrugated Steel Pipe 3 x 1 Corrugation - H2O Loading.
- 56-04 Thickness for Corrugated and Structural Plate Pipes for Railroad Cooper E72 Live Load.
- 56-07 Flared End Terminal Section Round Corrugated Metal Pipe.
- 56-10 Embankment Protector.
- 57-01 Thickness for Corrugated Steel Pipe Arch - H2O Loading.
- 57-02 Flared End Terminal Section Corrugated Metal Pipe Arch Culvert.
- 57-03 Bevel on Corrugated Steel Pipe Arch.
- 59-03 Step Bevel for Circular CSP and SSP.
- 65-01 Thickness for Corrugated Aluminum Pipe - H2O Live Load.
- 69-01 Semicircular Underdrain.
- 80-02 Median Barrier Fence.
- 82-01 Cattle Guard.
- 88-09 Signing of Median U Turns.
- 88-56 Typical Road Approach Signing.
- 88-58 Typical Crossroad and Ramp Layout.
- 88-59 Typical Guide Sign Placement.
- 88-74 X 1-1 Sign and Erection Detail.
- 88-92 Delineator Spacing for Horizontal Highway Curves.
- 90-17 Reflector Washer
- 90-18 Flex Beam Guard Rail Bridge Approach.
- 96-01 Monuments and Markers.

- NOTE - (1) Add these drawings to your book.
(2) We are also sending a complete new index, pages 1 through 6. You should destroy the old index, pages 1 through 5.

Melvin C. Rygg
Melvin C. Rygg, P.E.,
Office Engineer

REVISED

4-16-69

6-1-69

EFFECTIVE

6-1-69

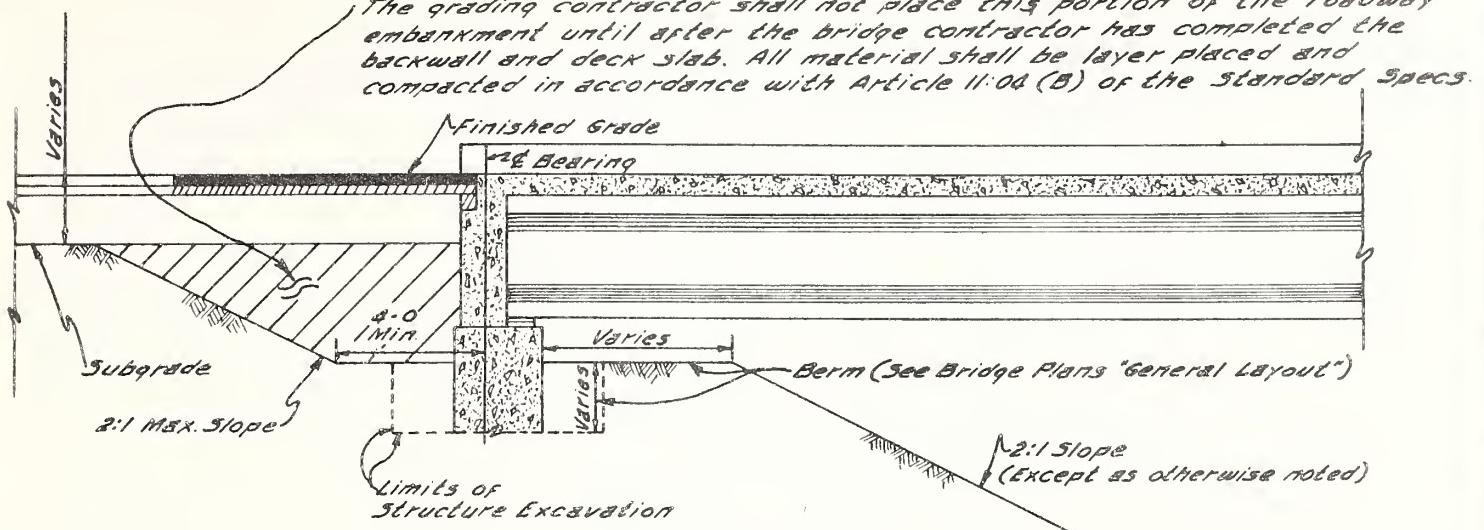
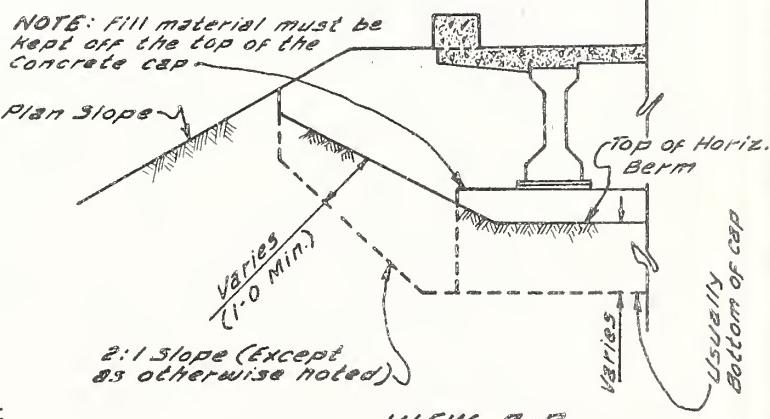
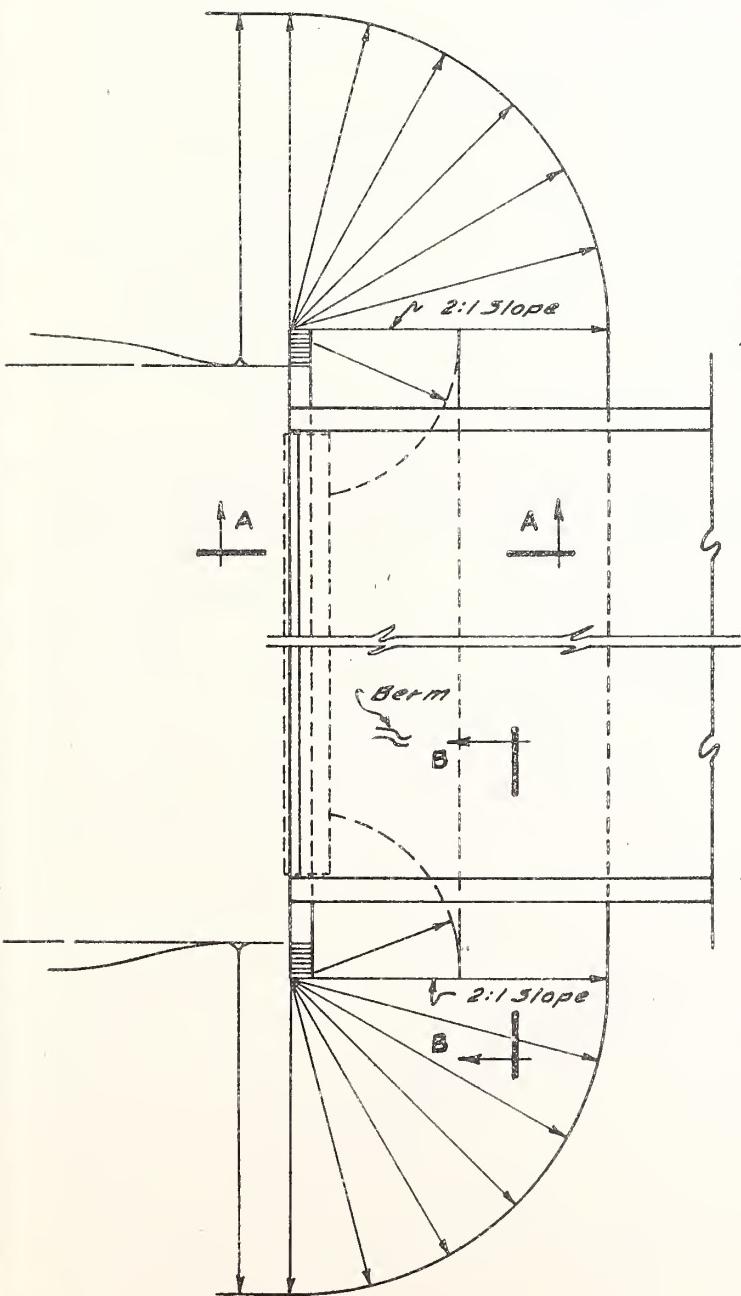
7-1-69

STANDARD DRAWING NO. 11-04

State Highway Commission
Helena, Montana

ROADWAY EMBANKMENT AT BRIDGE END

Approved

Lewis M. Galtier 8/2/69
State Highway EngineerSECTION A-AVIEW B-B
AT FINISHED BRIDGE END

PLAN VIEW AT FINISHED BRIDGE END



REVISED 5-1-63 11-1-68
EFFECTIVE 5-1-63 1-1-69

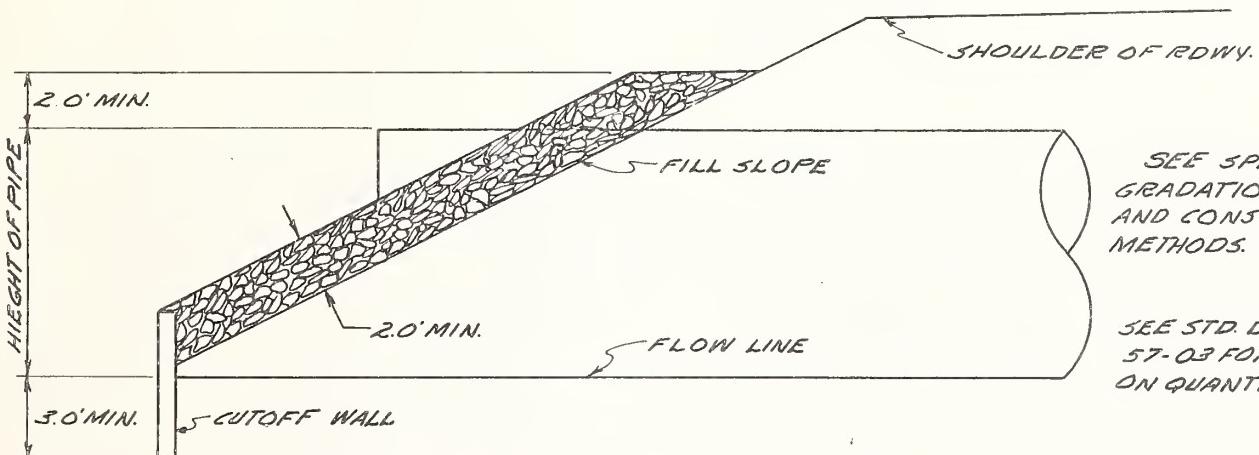
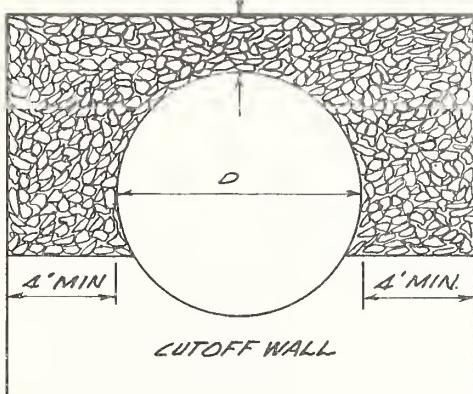
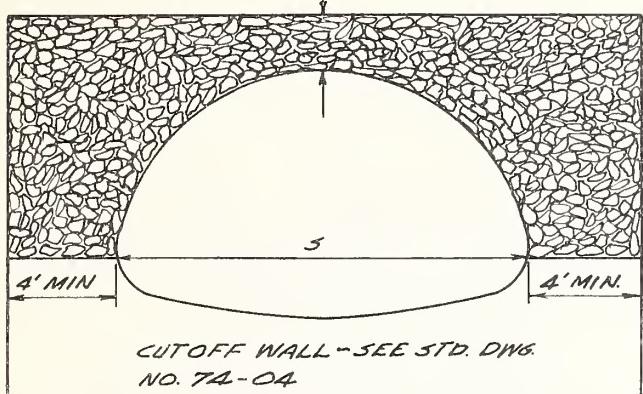
STANDARD DRAWING NO. 50-01

State Highway Commission
Helena, Montana

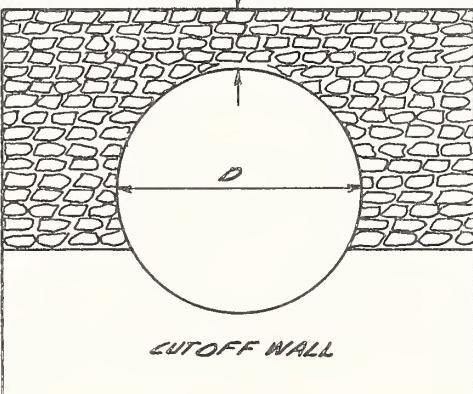
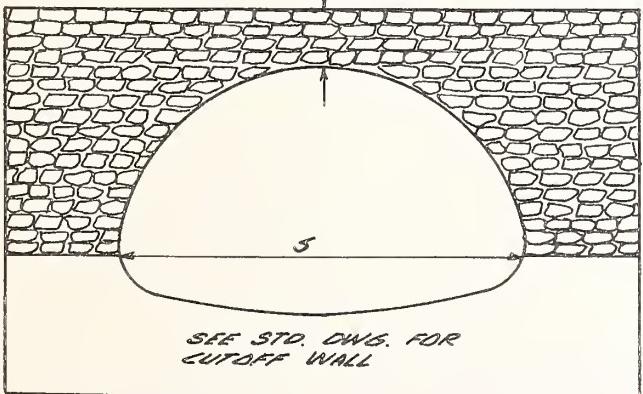
CULVERT RIPRAP

Approved
Luis M. Perea 10-28-68
State Highway Engineer

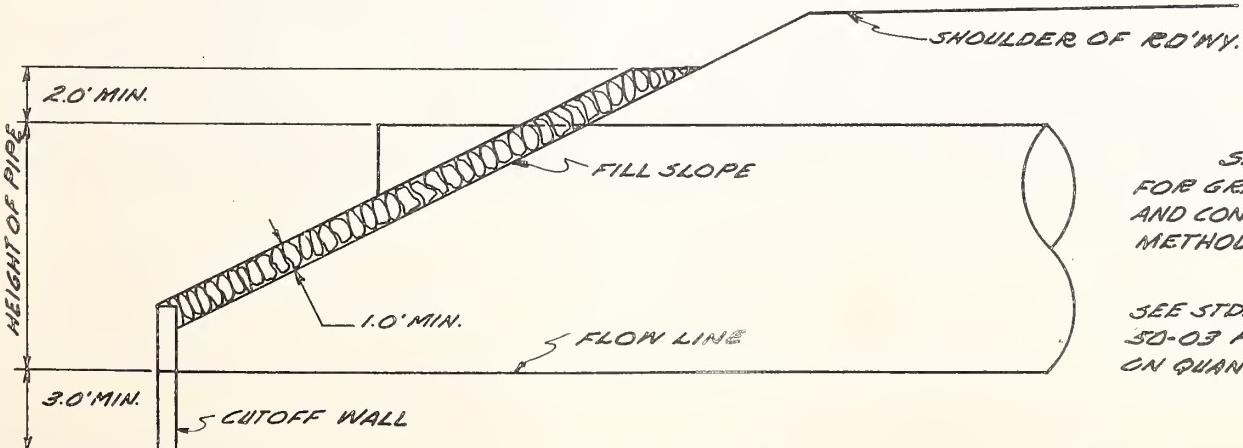
RANDOM RIPRAP



HAND LAID RIPRAP



ENDS OF RIPRAP WALLS SHALL BE KEYED INTO THE EMBANKMENT SLOPES A MIN. OF 2' FROM OUTER FACE OF THE RIPRAP FOR THE FULL HEIGHT OF THE RIPRAP WALL.



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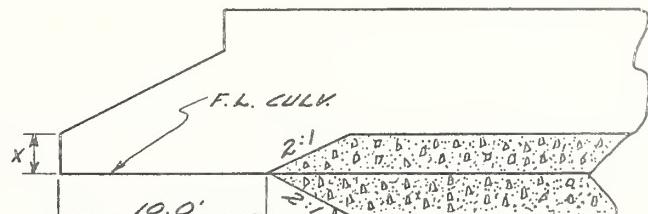
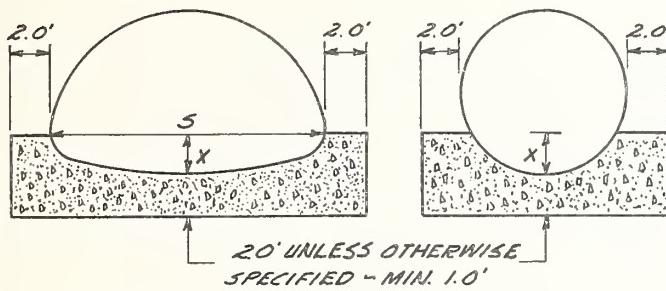
REVISED 1-1-68 11-20-68
EFFECTIVE 2-1-68 1-1-69

STANDARD DRAWING NO. 54-03

State Highway Commission
Helena, Montana

BEDDING MATERIAL

Approved
Jewell C. Phillips
State Highway Engineer



10.0'
IF SUITABLE FOR FOUNDATION, THIS MATERIAL SHOULD BE UNDISTURBED AND BEDDING AROUND PIPE COMPOSED OF EARTH TO PROVIDE SEAL

SEE STD. SPECIFICATIONS FOR GRADATION OF BEDDING MATERIAL

CIRCULAR C.S.P. & S.S.P.P.C.

DIAMETER OF PIPE (IN.)	CU.YDS. BEDDING MATERL. REQ'D. PER LIN. FT. FOR 2.0' THICKNESS	DIAMETER OF PIPE (IN.)	CU.YDS. BEDDING MATERL. REQ'D. PER LIN. FT. FOR 2.0' THICKNESS
60	0.94	162	2.45
66	1.02	168	2.55
72	1.09	174	2.66
78	1.16	180	2.77
84	1.25	192	2.99
90	1.33	198	3.10
96	1.41	204	3.22
102	1.50	210	3.34
108	1.58	216	3.45
114	1.67	228	3.69
120	1.76	240	3.94
126	1.85	252	4.20
132	1.95		
138	2.04		
144	2.14		
150	2.24		
156	2.34		

STRUCTURAL PLATE PIPE ARCH

SPAN	RISE	CU.YDS. BEDDING MATERL. REQ'D. PER LIN. FT. FOR 2.0' THICKNESS		
		1:2:1 BEV.	2:1 BEV.	2:2:1 BEV.
18" CORNER PLATES				
6'7"	4'7"	1.16	1.16	1.16
6'9"	4'11"	1.23	1.23	1.23
7'3"	5'3"	1.19	1.19	1.19
7'11"	5'7"	1.30	1.30	1.30
8'7"	5'11"	1.37	1.37	1.37
9'4"	6'3"	1.47	1.47	1.47
9'9"	6'7"	1.44	1.44	1.44
10'5"	6'11"	1.68	1.68	1.68
11'5"	7'3"	1.74	1.74	1.74
11'10"	7'7"	1.68	1.68	1.68
12'6"	7'11"	1.80	1.80	1.80
12'10"	8'4"	1.75	1.75	1.75
31" CORNER PLATES				
14'0"	9'8"	2.13	2.13	2.13
15'4"	10'4"	2.31	2.31	2.31
16'6"	11'0"	2.36	2.36	2.36
17'11"	11'8"	2.58	2.58	2.58
19'3"	12'4"	2.77	2.77	2.77
20'5"	13'0"	2.91	2.91	2.91

STRUCT. PLATE PIPE ARCH STOCK & VEHICULAR UNDERPASS

DESIGN	SPAN	RISE	CU.YDS. BEDDING MATERL. REQ'D. PER LIN. FT. (2 THICK)
99	6'11"	8'6"	1.15
129	10'10 $\frac{1}{2}$ "	9'11"	1.42
156	13'10"	11'9 $\frac{1}{2}$ "	2.29
180	15'6"	13'10"	2.53
192	16'2"	14'10"	2.42

STRUCT. PLATE PIPE STOCKPASS

DESIGN	SPAN	RISE	CU.YDS. BEDDING MATERL. REQ'D. PER LIN. FT. (2 THICK)
A	5'10"	6'6"	0.99
B	5'10"	7'7"	0.99

REVISED 5-9-68 11-20-68
EFFECTIVE 11-1-68 1-1-69

STANDARD DRAWING NO.

56-01

State Highway Commission
Helena, Montana

GAGE TABLE FOR CORRUGATED STEEL PIPE
 $2\frac{2}{3} \times \frac{1}{2}$ CORRUGATION H-20 LOADING

Approved
Luis G. Bellard
State Highway Engineer

GAGES FOR CIRCULAR CORRUGATED STEEL PIPE						
SEAM FABRICATION		RIVETED, WELDED OR HELICALLY FABRICATED				
AREA (SQ. FT.)	DIA. (INCHES)	HEIGHT OF COVER (FEET)				
		16 GAGE	18 GAGE	12 GAGE	10 GAGE	8 GAGE
1.2	15	67	73	93	98	100
1.8	18	47	55	70	82	86
2.4	21	37	43	50	58	64
3.1	24	30	33	40	48	54
4.9	30	24	25	29	33	37
7.1	36	21	22	24	26	28
9.6	42	19	20	21	23	24
12.6	48		19	20	21	22
15.9	54			19	20	21
19.6	60			18	19	20
23.8	66				18	19
28.3	72				18	18
33.2	78					18
38.5	84					18

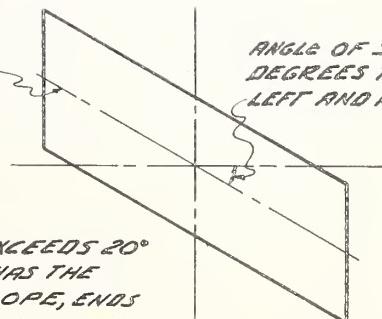
GAGES FOR ELONGATED CORRUGATED STEEL PIPE						
SEAM FABRICATION		RIVETED, WELDED OR HELICALLY FABRICATED				
AREA (SQ. FT.)	DIA. (INCHES)	HEIGHT OF COVER (FEET)				
		16 GAGE	14 GAGE	12 GAGE	10 GAGE	8 GAGE
1.2	15	67	73	93	98	100
1.8	18	47	55	70	82	86
2.4	21	37	43	50	58	64
3.1	24	30	33	40	48	54
4.9	30	34	36	47	49	52
7.1	36	28	30	39	41	43
9.6	42	31	38	43	46	48
12.6	48		37	40	42	44
15.9	54			38	39	41
19.6	60			34	38	40
23.8	66				35	38
28.3	72				25	31
33.2	78					25
38.5	84					20

NOTES:
USE SPECIAL DESIGN FOR STRUCTURES
WITH HEIGHTS OF COVER EXCEEDING
THESE TABLES.

MINIMUM COVER 2 FT.

CUT END OF CULVERT
PARALLEL TO % OF
ROAD WHEN SPECIFIED

ANGLE OF SKEW
DEGREES TO
LEFT AND RIGHT



NOTE:

WHEN SKEW ANGLE EXCEEDS 20°
AND THE PIPE ARCH HAS THE
ENDS CUT TO FIT A SLOPE, ENDS
SHALL BE REINFORCED WITH
MASONRY.

REVISED 8-1-67 11-20-68
EFFECTIVE 8-1-67 1-1-69

STANDARD DRAWING NO. 56-02

State Highway Commission

Helena, Montana

GAGE TABLE FOR CORRUGATED STEEL PIPE

3 X 1 CORRUGATION H-20 LOADING

Approved

Louis W. Smith
State Highway Engineer

FILL HEIGHT OF CIRCULAR CORRUGATED STEEL PIPE

SEAM FABRICATION		SPOT WELDED						
AREA (SQ. FT.)	DIA. (INCHES)	5/16" RIVETS OR HELICAL		3/8" RIVETS OR HELICAL FABRICATION				
		HEIGHT OF COVER (FT.)		16 GAGE	14 GAGE	12 GAGE	10 GAGE	8 GAGE
13	48	23		27	30	34	38	
16	54	20		24	26	29	32	
20	60	19		22	24	26	28	
24	66	17		20	22	23	25	
28	72	15		20	21	22	23	
33	78	14		19	20	21	22	
38	84			19	19	20	21	
44	90			18	19	19	20	
50	96				18	19	20	
57	102				18	19	19	
64	108				18	19	19	
71	114					18	19	
78	120					18	19	

FILL HEIGHT FOR ELONGATED CORRUGATED STEEL PIPE

SEAM FABRICATION		SPOT WELDED						
AREA (SQ. FT.)	DIA. (INCHES)	5/16" RIVETS OR HELICAL		3/8" RIVETS OR HELICAL				
		HEIGHT OF COVER (FT.)		16 GAGE	14 GAGE	12 GAGE	10 GAGE	8 GAGE
10								
13	48	23		34	52	54	57	
16	54	20		29	47	48	50	
20	60	19		26	42	43	45	
24	66	17		24	38	39	41	
28	72	15		22	35	36	38	
33	78	14		21	32	33	35	
38	84			19	30	31	32	
44	90			18	28	29	30	
50	96				26	27	28	
57	102				25	25	26	
64	108				23	24	25	
71	114					22	24	
78	120					21	22	

-NOTES-

USE SPECIAL DESIGN FOR STRUCTURES WITH
HEIGHTS OF COVER EXCEEDING THESE TABLES.

IF SKEW IS REQUIRED SEE STD. DWG. NO. 56-01

MINIMUM COVER - 2 FT.

REVISED 8-1-67 11-20-68
EFFECTIVE 8-1-67 1-1-69

STANDARD DRAWING NO. 56-03

State Highway Commission
Helena, Montana

GAGE TABLE FOR CORRUGATED STEEL PIPE
3x1 CORRUGATION H-20 LOADING

Approved
Lance M. Custer
State Highway Engineer

SEAM FABRICATION		SPOT WELDED OR BOLTED ($\frac{1}{2}$ " A325 Bolts)				
AREA Sq. Ft.	DIAMETER Inches	HEIGHT OF COVER (Feet)				
		$\frac{3}{8}$ " Rivets	$\frac{7}{16}$ " Rivets	16 gage	14 gage	12 gage
13	48			24	27	30
16	54			22	24	26
20	60			21	22	24
24	66			20	20	22
28	72			19	20	21
33	78			18	19	20
38	84				19	20
44	90				18	19
50	96					19
57	102					20
64	108					19
71	114					19
78	120					19

SEAM FABRICATION		SPOT WELDED OR BOLTED ($\frac{1}{2}$ " A325 Bolts)				
AREA Sq. Ft.	DIAMETER (In.)	HEIGHT OF COVER (Feet)				
		$\frac{3}{8}$ " Rivets	$\frac{7}{16}$ " Rivets	16 gage	14 gage	12 gage
13	48			32	44	60
16	54			29	39	52
20	60			25	35	48
24	66			23	32	44
28	72			22	29	42
33	78			20	27	40
38	84				25	38
44	90				23	37
50	96					35
57	102					33
64	108					31
71	114					32
78	120					30

NOTES: Use special design for structures with
Heights of cover exceeding these tables.
If skew is required see Std. Dwg. No. 56-01
Minimum cover 2 Ft.

REVISED 9-21-66 / 11-20-68
EFFECTIVE 12-1-67 / 1-1-69

STANDARD DRAWING NO. 56-04

State Highway Commission
Helena, Montana

GAGE TABLES FOR CORRUGATED & STRUCTURAL PLATE PIPES
FOR RAILROAD COOPER E 72 LIVE LOAD

Approved
L. C. Phillips 12-7-68
State Highway Engineer

GAGES OF CORRUGATED METAL PIPE
(ROUND OR VERTICALLY ELONGATED)

Diam. in. inches	Area in Sq. Ft.	Height of Cover Above Top of Culvert - in Feet									
		1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100
18	1.8	14	14	14	14	14	14	12	12	12	12
21	2.4	14	14	14	14	14	12	12	12	10	10
24	3.1	14	14	14	14	12	12	12	10	10	10
30	4.9	14	14	12	12	10	10	10	8*	8*	8*
36	7.1	12	12	12	10	8	8	8*	8*	8*	8*
42	9.6	12	12	10	8	8	8*	8*	8*	8*	8*
+ 42	9.6						8	8*	8*	8*	8*
+ 48	12.6	10	10	8	8	8	8	8*	8*	8*	8*
+ 54	15.9	8	8	8	8	8*	8*	8*	8*		
+ 60	19.6	8	8	8	8	8*					
+ 66	23.8	8	8	8*							
+ 72	28.3	8	8*								

* Make a trench one diameter deep in original soil or in compacted fill.
The gages shown are the minimum structural requirements for use with adequate backfill.

For recommended minimum height of cover, see below.

+ Values below line are based on vertical elongation of pipe.

GAGES OF CORRUGATED
METAL PIPE-ARCHES

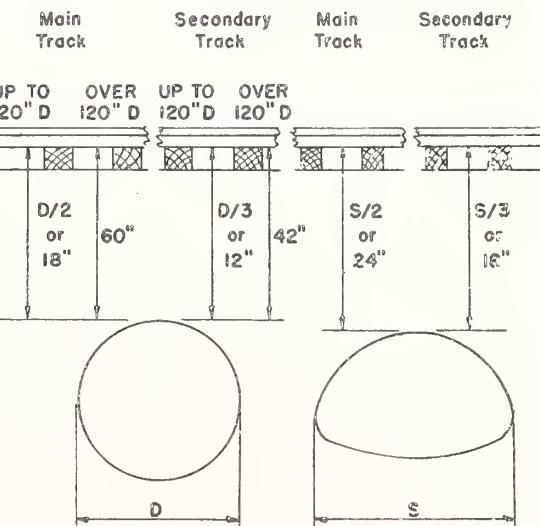
Diam. of Pipe of Equal Periph. in Inches	Span in Inches	Rise in Inches	Height of Cover - in Feet			
			2	3-4	5-7	8-15
15	18	11	14	14	14	14
18	22	13	14	14	14	14
21	25	16	12	14	14	14
24	29	18	12	12	14	14
30	36	22	10	12	12	12
36	43	27	8	10	10	12
42	50	31		5	10	10
48	58	36			8	8
54	65	40				8
60	72	44				8

GAGES OF STRUCTURAL PLATE PIPE
(VERTICALLY ELONGATED)

Diam. in. inches	Height of Cover - in Feet															
	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-70	71-80	81-90	91-100
50	12	12	12	12	12	12	12	12	12	10	10	8	7	5	5	
56	12	12	12	12	12	12	12	12	12	10	10	8	8	7	5	3
72	12	12	12	12	12	12	12	12	10	10	8	8	7	5	3	1
78	10	12	12	12	12	12	10	10	8	8	8	8	5	3	1	
84	10	12	12	12	12	12	10	10	8	8	8	7	5	3	1	
90	10	12	12	12	12	12	10	10	8	8	7	5	3	1		
96	8	12	12	12	12	10	10	10	8	7	7	5	3	1		
108	8	10	10	10	10	10	10	8	7	5	5	3	1			
120	8	10	10	10	10	10	8	7	5	5	3	1				
132	8	10	10	10	10	8	8	7	5	3	1	1				
144	7	8	10	10	8	8	7	5	3	1	1					
156	7	8	8	8	8	5	3	1	1							
168	7	8	8	8	7	5	3	1								
180	7	8	8	8	8	5	3	1								

Use special design for structures with height of cover exceeding this table.

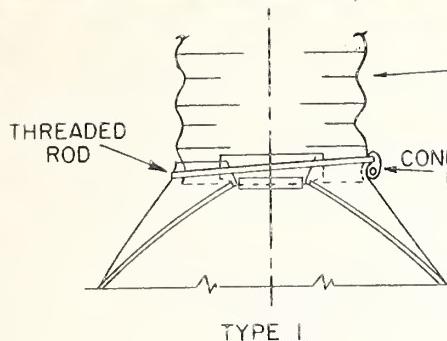
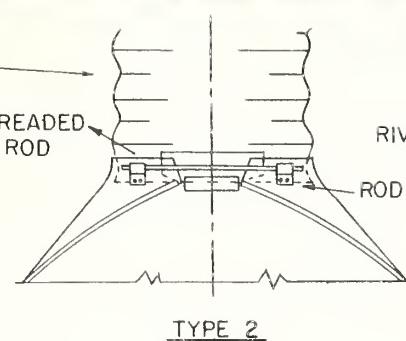
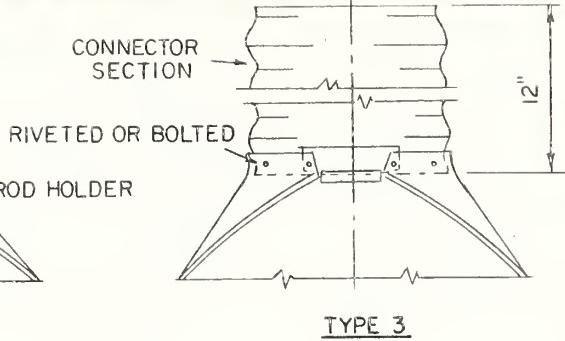
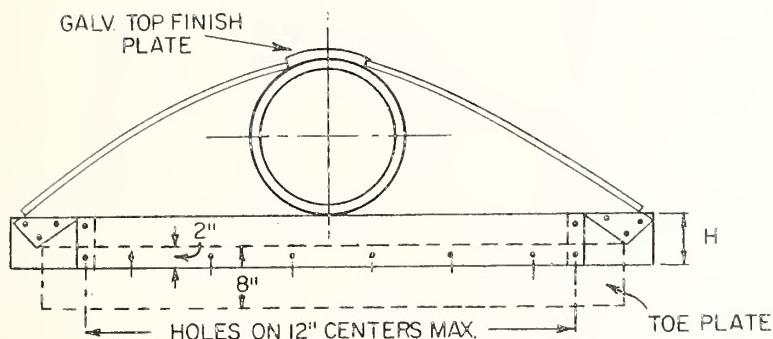
PIPE PIPE-ARCHES



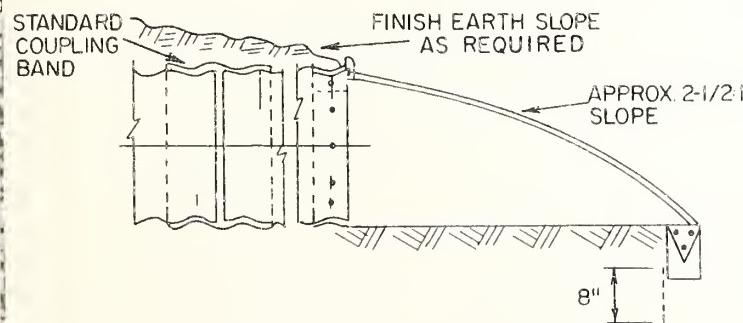
Minimum height of cover for corrugated metal structures under Cooper E 50 to E 72 railroad loadings, for main and secondary tracks.

REVISED EFFECTIVE	1-1-64	1-30-69	6-1-69
	1-1-64	1-1-69	7-1-69

STANDARD DRAWING NO. 56-07

State Highway Commission
Helena, MontanaFLARED END TERMINAL SECTION
ROUND CORRUGATED METAL PIPEApproved
Loring Clinton 12-7-68
State Highway EngineerFOR 12" THRU 24" ONLY
STANDARD CONNECTIONFOR 30" AND 36" ONLY
STANDARD CONNECTIONFOR 42" AND 48"
STANDARD CONNECTION

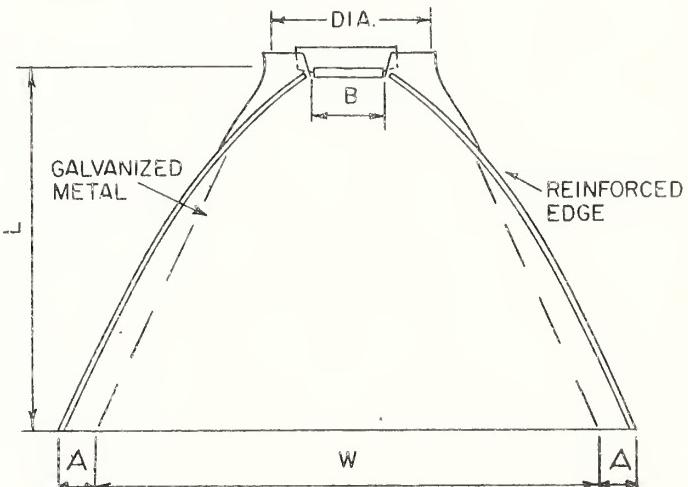
ELEVATION



TYPICAL CROSS-SECTION

(ILLUSTRATED WITH TYPE 3 CONNECTION)

PIPE DIAM	MIN. GA.	DIMENSIONS				
		A 1" Tol	B Max.	H 1" Tol	L 1½" Tol	W 2" Tol
12"	16	6	6"	6"	21"	24"
15"	16	7	8	6	26	30
18"	16	8	10	6	31	36
21"	16	9	12	6	36	42
24"	18	10	13	6	41	48
30"	14	12	16	8	51	60
36"	14	14	19	9	60	72
42"	12	16	22	11	69	84
48"	12	18	27	12	78	90



PLAN

Flared end terminal section to be included in length of pipe shown on plans.

All parts are to be galvanized in accordance with AASHO M 36.

Any areas where galvanizing is broken or metal is bare shall be painted with one coat of red lead or zinc chromate prime and two coats of aluminum paint.

Minor variations in design will be acceptable, however the tolerances must not be exceeded. Seams or joints lengthwise of the apron will be acceptable if securely welded and painted as provided above.

REVISED 8-1-67 11-20-68
EFFECTIVE 8-1-67 1-1-69State Highway Commission
Helena, Montana

STANDARD DRAW NO.

57-01

GAGE TABLE FOR CORRUGATED STEEL PIPE ARCH Approved
H-20 LOADING*Louis J. Brattin*
State Highway EngineerGAGES FOR CORRUGATED STEEL PIPE ARCH
 $2\frac{3}{5} \times \frac{1}{8}$ " CORRUGATION RIVET, WELD OR HELICALLY FABRICATED

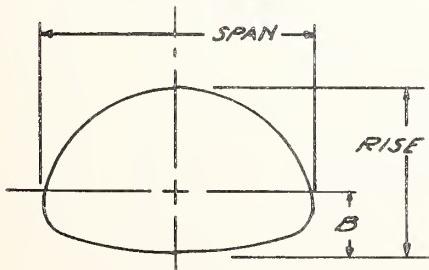
AREA (Sq.Ft.)	SPAN (In.)	RISE (In.)	DIA. OF PIPE OF EQ. PER.	MINIMUM GAGE	AYOUT DIM. B (In.)	MAXIMUM COVER (Ft.)	MINIMUM COVER (Ft.)
1.1	18	11	15	16	9 $\frac{1}{2}$	13	2
1.6	22	13	18	16	9 $\frac{3}{4}$	12	2
2.2	25	16	21	16	5 $\frac{1}{4}$	10	2
2.8	29	18	24	16	5 $\frac{1}{2}$	9	2
4.4	36	22	30	16	6 $\frac{1}{4}$	9	2
6.4	43	27	36	16	7	7	2
8.7	50	31	42	14	8	7	2
11.4	58	36	48	12	9 $\frac{1}{4}$	7	2
14.3	65	40	54	12	10 $\frac{1}{2}$	7	2
17.6	72	44	60	10	11 $\frac{1}{4}$	7	2
21.3	79	49	66	8	13 $\frac{1}{2}$	7	2
25.3	85	54	72	8	14 $\frac{1}{2}$	7	2

NOTE: Use special design for structures with
heights of cover exceeding these tables.GAGES FOR CORRUGATED STEEL PIPE ARCH
 3×1 " CORRUGATION RIVET, WELD OR HELICALLY FABRICATED

AREA (Sq.Ft.)	SPAN (In.)	RISE (In.)	DIA. OF PIPE OF EQ. PER.	MINIMUM GAGE	AYOUT DIM. B (In.)	MAXIMUM COVER (Ft.)	MINIMUM COVER (Ft.)
11.4	58	36	48	16	13	12	2
14.3	65	40	54	16	14 $\frac{3}{4}$	12	2
17.6	72	44	60	16	16 $\frac{1}{2}$	12	2
22	73	55	66	16	21	15	2
26	81	59	72	14	21 $\frac{1}{2}$	15	2
31	87	63	78	14	22	14	2
35	95	67	84	12	22 $\frac{1}{2}$	12	2
40	103	71	90	12	23	11	2.5
46	112	75	96	12	23 $\frac{1}{2}$	10	2.5
52	117	79	102	12	24	10	2.5
58	128	83	108	10	24 $\frac{1}{2}$	10	2.5

NOTES: Use special design for structures with
heights of cover exceeding these tables.
If skew is required see Std. Dwg N^o. 60-02

PIPE-ARCH SHAPE



NOTE: See Std Dwg # 73-08 if cutoff wall is required.

STATE HIGHWAY COMMISSION
HELENA, MONTANA 59601

July 1, 1969

STANDARD DRAWING BOOK

We are sending the following additions and/or revisions effective July 1, 1969, to be included in your present Standard Drawing Book, the grey covered one, original issue January 1, 1969.

- 07-03 Construction Identification Signs CIS-1 & CIS-2.
- 11-04 Roadway Embankment at Bridge End.
- 13-02 Measurement of Roadway Rolling.
- 39-04 8" P.C. Concrete Pavement Construction Joint & Header.
- 50-05 Concrete Drainage Chute.
- 56-07 Flared End Terminal Section Round Corrugated Metal Pipe.
- 56-10 Embankment Protector
- 57-02 Flared End Terminal Section Corrugated Metal Pipe-Arch Culvert.
- 57-03 Bevel on Corrugated Steel Pipe Arch.
- 69-01 Semicircular Drain
- 83-39 Weigh Station Signs
- 83-91 Delineators Type I.
- 88-91A Delineators Type II.
- 90-02 Metal Guard Rail.
- 90-05 Multilane Bridge End and Bridge Pier Treatment.
- 90-15 Combination Guard Rail and Header
- 100-13 Historical Markers.

- NOTE - (1) Add these drawings to your book.
(2) We are also sending a complete new index, pages 1 through 5. You should destroy the old index, pages 1 through 5.

Melvin C Rygg
Melvin C. Rygg, P. E.,
Office Engineer

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REVISED 4-20-67
EFFECTIVE 6-1-67

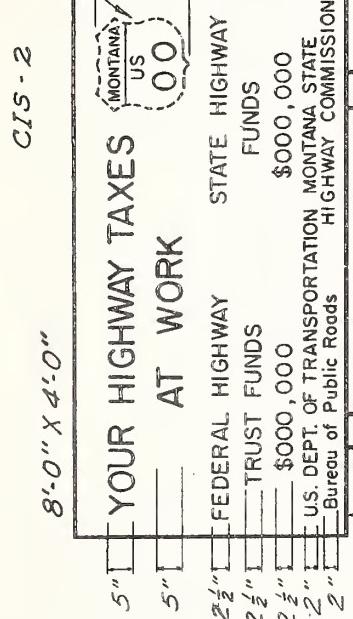
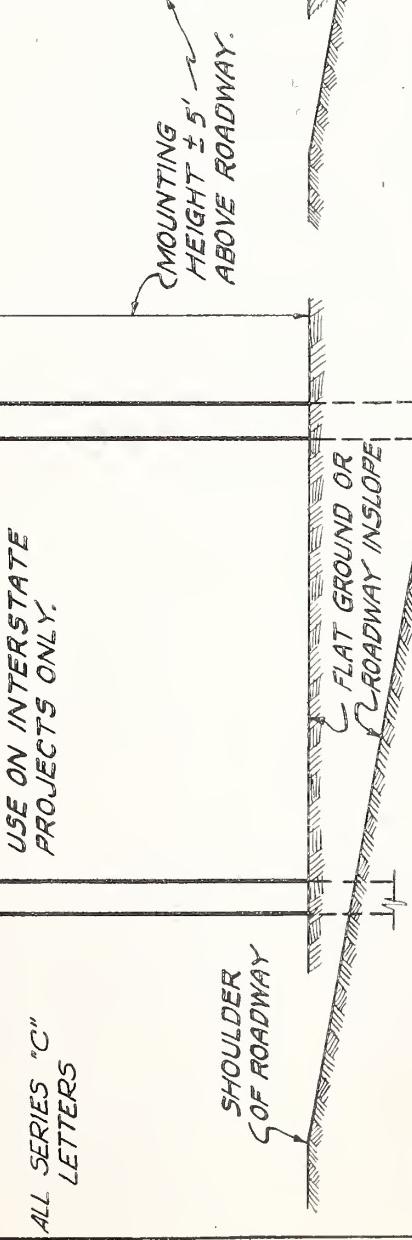
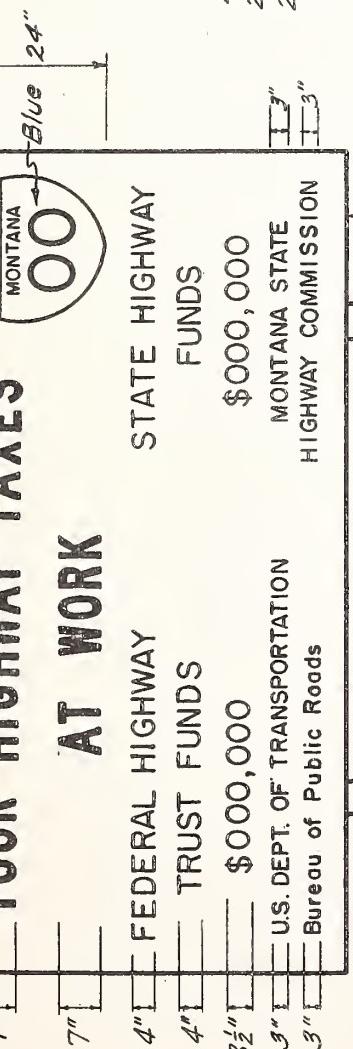
STANDARD DRAWING NO. 07-03

State Highway Commission
Helena, Montana

CONSTRUCTION IDENTIFICATION SIGNS - CIS-1 & CIS-2

Approved

J. Lewis M. Phillips
State Highway Engineer



NOTES:-

THE CONSTRUCTION SIGNS SHALL BE FURNISHED, ERECTED AND MAINTAINED BY THE CONTRACTOR. SIGN FACE SHALL BE EXTERIOR GRADE PLYWOOD WITH A SMOOTH AND FLAT FACE, LETTERED AS SHOWN. PLYWOOD SHALL BE OF ADEQUATE THICKNESS TO FORM A FLAT AND RIGID SIGN. SPLICING MAY BE PERMITTED WITH ADEQUATE BACKING. SIGNS TO BE SECURELY MOUNTED ON SUBSTANTIAL POSTS OR POLES.

LETTERING WILL BE AS SHOWN USING B.P.R. STANDARD ALPHABETS (SERIES "C") AND MAY BE OF DETACHABLE PLATES IF THE CONTRACTOR SO CHOOSES.

THE INTERSTATE SHIELD SHALL HAVE WHITE LEGEND ON INTERSTATE BLUE AND RED BACKGROUND AS INDICATED. THE ABOVE SIGNS SHALL HAVE BLACK LEGEND ON A WHITE NON-REFLECTORIZED BACKGROUND.

SIGNS TO BE INSTALLED WILL BE AS SPECIFIED ON THE PLANS OR IN THE SPECIAL PROVISIONS. THE EXACT LOCATION FOR ERECTION WILL BE DETERMINED BY THE ENGINEER.

INFORMATION CONCERNING ROUTE NUMBER AND FUNDS DISTRIBUTION WILL BE DETERMINED BY THE ENGINEER. THE CONTRACTOR SHALL NOT ERECT SAID SIGNS UNTIL THE CORRECT LEGEND HAS BEEN DETERMINED. SIGNS SHALL BE ERECTED BEFORE THE START OF WORK. UPON TERMINATION OF THE CONTRACT, THE SIGNS SHALL BE REMOVED BY THE CONTRACTOR.

ALL THE COST OF FURNISHING, ERECTING, MAINTAINING AND REMOVING OF THE SIGNS SHALL BE ABSORBED AND INCLUDED IN THE OTHER ITEMS OF THE CONTRACT. SIGNS TO BE PLACED WHERE THEY CAN BE READILY SEEN BY TRAVELING PUBLIC. PLACE WITH EDGE OF SIGN NO CLOSER THAN TWO FEET FROM SHOULDER OF ROADWAY.

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REVISED 12-30-66 10-18-68
EFFECTIVE 2-1-67 1-1-67

STANDARD DRAWING NO. 13-02

State Highway Commission
Helena, Montana

MEASUREMENT OF
ROADWAY ROLLING

Approved
Lewis M. Cutts 10-24-68
State Highway Engineer

OPERATING WEIGHT IN TONS (1)

TABLE 1A-A UNIT VALUES

TOTAL MEASURED	4-6	6-8	8-10	10-12	12-15	15-19	19-24	24-30	30-37	37-45	45-54	54-64	64-75	75-87
48"-55"	0.657	0.872	1.086	1.300	1.514	1.728	1.943	2.158	2.372	2.585	2.800	3.014	3.228	3.443
55"-60"	0.635	0.850	1.064	1.278	1.492	1.706	1.921	2.136	2.350	2.563	2.778	2.992	3.206	3.421
60"-65"	0.614	0.829	1.043	1.257	1.471	1.685	1.900	2.115	2.329	2.542	2.757	2.971	3.185	3.400
65"-70"	0.593	0.808	1.022	1.236	1.450	1.664	1.879	2.094	2.308	2.521	2.736	2.950	3.164	3.379
70"-75"	0.571	0.786	1.000	1.214	1.428	1.642	1.857	2.072	2.286	2.500	2.714	2.928	3.142	3.357
75"-80"	0.550	0.765	0.979	1.193	1.407	1.621	1.836	2.051	2.265	2.478	2.693	2.907	3.121	3.336
80"-85"	0.528	0.743	0.957	1.171	1.385	1.600	1.814	2.029	2.243	2.456	2.671	2.885	3.100	3.314
85"-90"	0.507	0.722	0.936	1.150	1.364	1.578	1.793	2.008	2.222	2.435	2.650	2.864	3.078	3.293
90"-95"	0.485	0.700	0.914	1.128	1.342	1.556	1.771	1.986	2.200	2.413	2.628	2.842	3.056	3.271
95"-100"	0.464	0.679	0.893	1.107	1.321	1.535	1.750	1.965	2.179	2.392	2.607	2.821	3.035	3.250
100"-105"	0.443	0.658	0.872	1.086	1.300	1.514	1.729	1.944	2.158	2.371	2.586	2.800	3.014	3.229
105"-110"	0.421	0.636	0.850	1.064	1.278	1.492	1.707	1.922	2.136	2.349	2.564	2.778	2.992	3.207
110"-115"	0.400	0.615	0.829	1.043	1.257	1.471	1.686	1.901	2.115	2.328	2.543	2.757	2.971	3.186
115"-120"	0.378	0.593	0.807	1.021	1.235	1.449	1.664	1.879	2.093	2.306	2.521	2.735	2.949	3.164
120"-125"	0.357	0.572	0.786	1.000	1.214	1.428	1.643	1.858	2.072	2.285	2.500	2.714	2.928	3.143
125"-130"	0.335	0.550	0.764	0.978	1.192	1.406	1.621	1.836	2.050	2.263	2.478	2.693	2.906	3.121
130"-135"	0.314	0.529	0.743	0.957	1.171	1.385	1.600	1.815	2.029	2.242	2.457	2.671	2.885	3.100
135"-140"	0.293	0.508	0.722	0.936	1.150	1.364	1.579	1.794	2.008	2.221	2.436	2.650	2.864	3.079
140"-145"	0.271	0.486	0.700	0.914	1.128	1.342	1.557	1.772	2.086	2.200	2.414	2.628	2.842	3.057
145"-150"	0.250	0.465	0.679	0.893	1.107	1.321	1.536	1.751	1.965	2.178	2.393	2.607	2.821	3.036
150"-155"	0.228	0.443	0.657	0.871	1.085	1.299	1.514	1.729	1.943	2.156	2.371	2.595	2.800	3.014
155"-160"		0.422	0.636	0.850	1.064	1.278	1.493	1.708	1.922	2.135	2.350	2.564	2.778	2.993
160"-165"		0.400	0.614	0.828	1.042	1.256	1.471	1.686	1.900	2.113	2.328	2.542	2.756	2.971
165"-170"		0.379	0.593	0.807	1.021	1.235	1.450	1.665	1.879	2.092	2.307	2.521	2.735	2.950
170"-175"		0.358	0.572	0.786	1.000	1.214	1.429	1.644	1.858	2.071	2.286	2.500	2.714	2.929
175"-180"		0.336	0.550	0.764	0.957	1.192	1.407	1.622	1.836	2.049	2.264	2.478	2.692	2.907
180"-185"		0.315	0.529	0.743	0.936	1.171	1.386	1.601	1.815	2.028	2.243	2.457	2.671	2.886
185"-190"		0.293	0.507	0.721	0.914	1.149	1.364	1.579	1.793	2.006	2.221	2.435	2.649	2.864
190"-195"		0.272	0.486	0.700	0.914	1.128	1.343	1.558	1.772	1.985	2.200	2.414	2.628	2.843
195"-200"		0.251	0.465	0.679	0.893	1.107	1.322	1.537	1.751	1.964	2.179	2.393	2.607	2.822

1. OPERATING WEIGHT IN TONS "10-12" MEANS TEN TONS OR MORE BUT LESS THAN TWELVE.
2. ROLLING WIDTH MEANS TOTAL WIDTH OF TRACK OR TRACKS MADE BY ROLLER, MEASURED IN INCHES. SEE STANDARD DRAWING NO. 13-01 48"-55" MEANS 48" OR MORE, BUT LESS THAN 55"; etc, etc.
3. WHEN THE DRIVE WHEELS OR DRUMS OF A POWER UNIT ARE DESIGNED AND CONSTRUCTED FOR ROLLING AND COMPACTING, THEN SUCH WHEELS OR DRUMS WILL BE INCLUDED IN ROLLING WIDTH.
4. WHEN THE ROLLER IS A VIBRATING TYPE, THE FACTOR IN TABLE 1A-A IS TO BE MULTIPLIED BY 2 TO DETERMINE PAY QUANTITY. THE WEIGHT TO BE USED IS THE OPERATING WEIGHT.
5. WHEN THE ROLLER IS A TOWED TAMPING ROLLER, MULTIPLY THE FACTOR IN TABLE 1A-A BY 1.50 TO DETERMINE PAY QUANTITY.
6. WHEN MORE THAN ONE ROLLER IS PULLED BY ONLY ONE POWER UNIT, MEASURE ALL ROLLERS AND ADD TOGETHER AS A TEAM COMBINED INTO ONE ROLLER.

7. THE POWER UNIT IS NOT TO BE INCLUDED IN ANY MEASUREMENTS WHEN THE ROLLING EQUIPMENT IS BEING TOWED.
8. FOR ROLLER WIDTHS AND ROLLER WEIGHTS NOT ON THE TABLE, PROJECT AT SAME RATES WITHIN TABLE. ALL PROJECTIONS COMPUTED IN FIELD OFFICES MUST BE APPROVED PRIOR TO USE, BY THE HELENA OFFICE.
9. ILLUSTRATIVE COMPUTATION OF PAY QUANTITY:
 - (a) MEASURE ROLLING WIDTH! ANSWER---157 INCHES.
 - (b) DETERMINE OPERATING WEIGHT. ANSWER-34.5 TONS.
 - (c) THE PAYTIME FOR THE ROLLER IN A PAY PERIOD IS 210 HOURS.
 - (d) LOOK INTABLE 1A-A UNIT VALUES. ON LINE INCLUDING 157"(155-160), UNDER COLUMN INCLUDING 34.5 TONS (30-37), FIND UNIT VALUE OF 1.922.
 - (e) MULTIPLY 1.922 BY 210, GETTING 403.6 UNITS.

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REVISED 3-1-66
EFFECTIVE 3-1-66

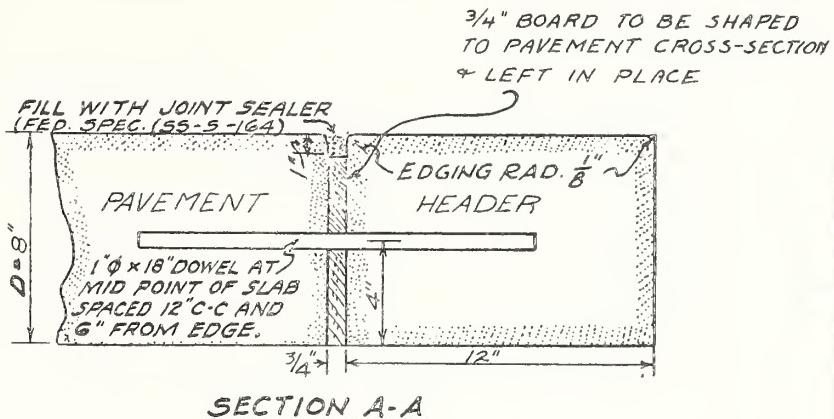
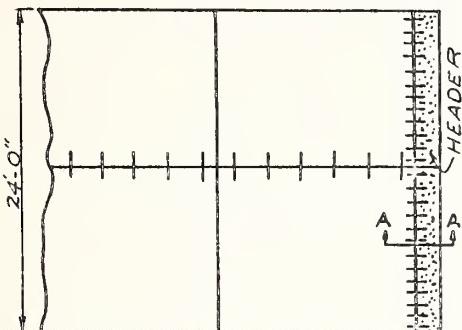
State Highway Commission
Helena, Montana

8" P.C. CONCRETE PAVEMENT CONSTRUCTION JOINT & HEADER

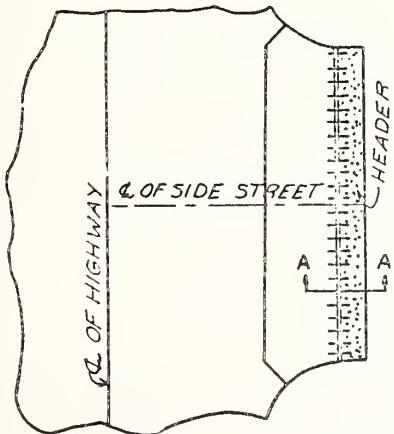
STANDARD DRAWING NO. 39-04

APPROVED
Signed by State Highway Engineer
Date 10-25-68

HEADER



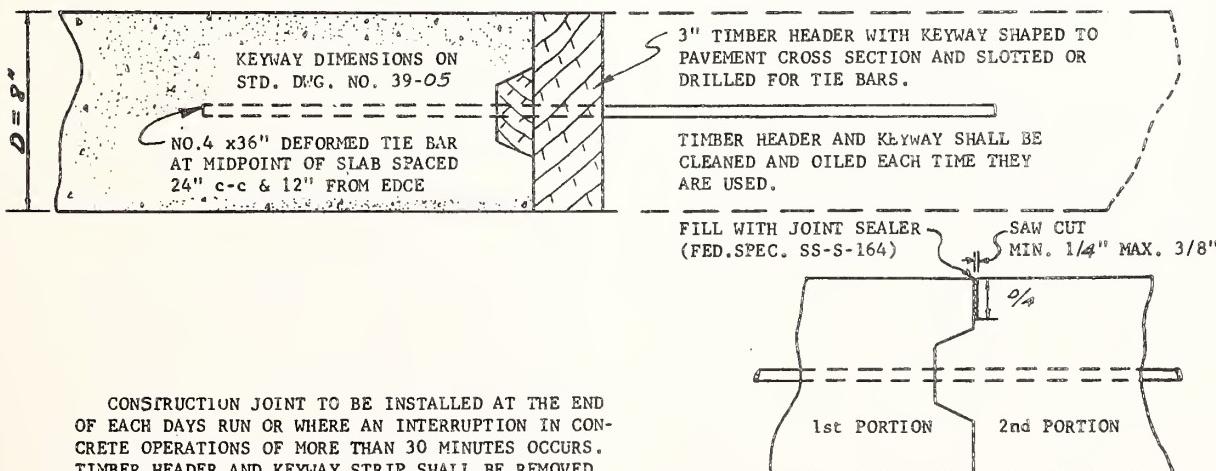
SECTION A-A



HEADERS TO BE CONSTRUCTED AT BEGINNING AND END OF PAVEMENT, AT INTERSECTING ROADS AND STREET RETURNS WHERE FUTURE P. C. CONCRETE PAVEMENT MAY BE CONSTRUCTED.

THE CONTRACTOR SHALL FURNISH CHAIRS, STAKES AND/OR SUPPORTING DEVICES CAPABLE OF HOLDING THE DOWELS, AND JOINT FILLER, SECURELY AND RICIDLY, IN THEIR REQUIRED POSITIONS. THE DOWEL AND JOINT FILLER SUPPORTING DEVICES MAY BE FACTORY ASSEMBLED. THE CONTRACTOR SHALL FURNISH THE ENGINEER WITH DETAIL DRAWINGS OF THESE DEVICES, A SUFFICIENT TIME IN ADVANCE OF CONSTRUCTION, FOR HIS APPROVAL. ANY APPROVAL OF DRAWINGS OF THESE DEVICES SHALL BE CONSIDERED TENTATIVE AND FINAL APPROVAL SHALL BE CONTINGENT UPON THEIR SATISFACTORY PERFORMANCE.

CONSTRUCTION JOINT



CONSTRUCTION JOINT TO BE INSTALLED AT THE END OF EACH DAY'S RUN OR WHERE AN INTERRUPTION IN CONCRETE OPERATIONS OF MORE THAN 30 MINUTES OCCURS. TIMBER HEADER AND KEYWAY STRIP SHALL BE REMOVED WHEN CONCRETE OPERATIONS ARE RESUMED AND FRESH CONCRETE PLACED DIRECTLY AGAINST THE OLD.

SMOOTH STEEL DOWELS, 3/4"
BOARD JOINT SEALER, TIMBER HEADER
WITH KEYWAY, JOINT SEALER, AND
SUPPORTING DEVICES TO BE INCLUDED
IN THE UNIT PRICE BID PER SQUARE YARD
FOR P. C. CONCRETE PAVEMENT.

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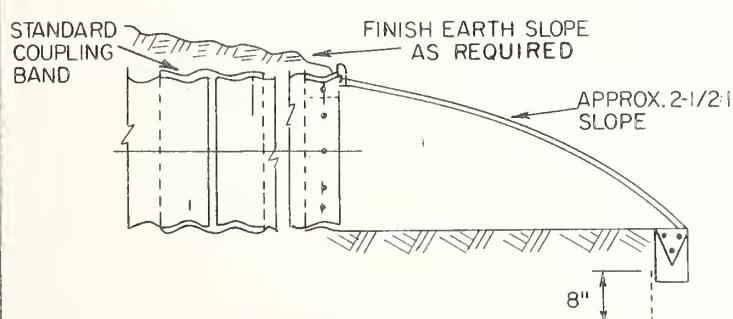
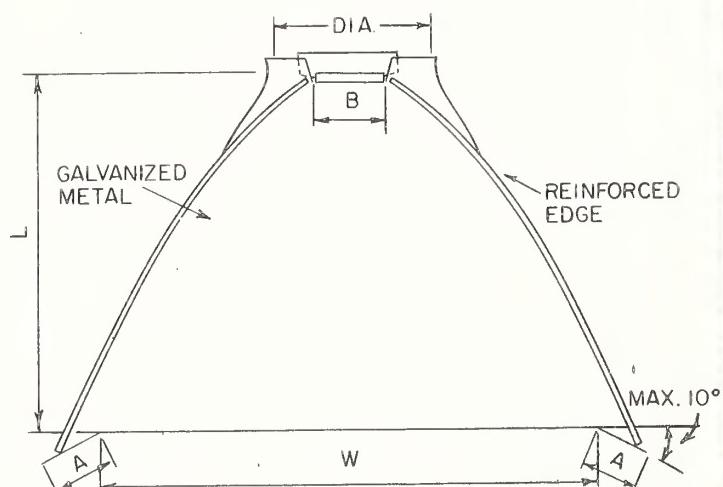
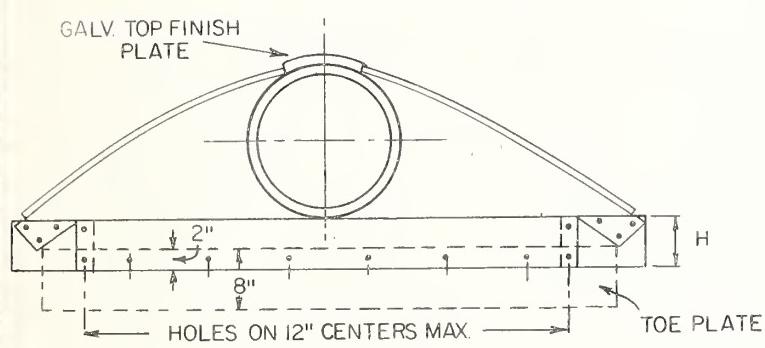
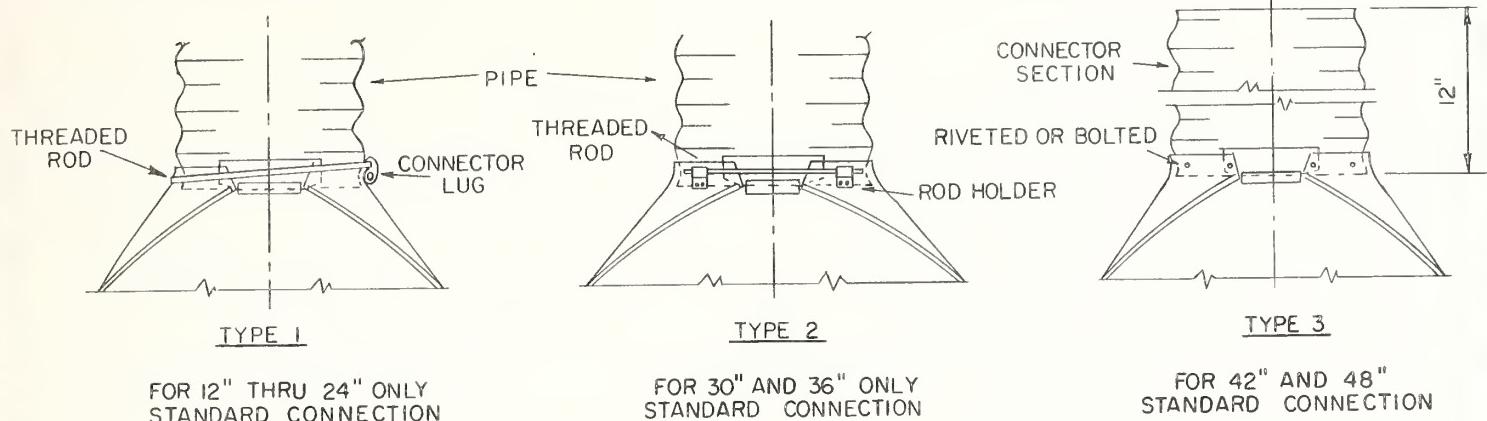
REVISED 1-1-64 11-20-68
EFFECTIVE 1-1-64 1-1-69

STANDARD DRAWING NO. 56-07

State Highway Commission
Helena, Montana

FLARED END TERMINAL SECTION
ROUND CORRUGATED METAL PIPE

Approved
Loring Clutton 12-9-68
State Highway Engineer



TYPICAL CROSS-SECTION
(ILLUSTRATED WITH TYPE 3 CONNECTION)

PIPE DIAM.	MIN. GA.	DIMENSIONS				
		A 1" Tol	B Max.	H 1" Tol	L 1 1/2" Tol	W 2" Tol
12"	16	4 3/4"	6"	6"	21"	24"
15"	16	6	8	6	26	30
18"	16	7	9	6	31	36
21"	16	8 1/4	11	6	36	42
24"	16	9 1/2	12	6	42	48
30"	14	12	15	7 1/2	52 1/2	60
36"	12	14	18	9	63	72
42"	12	16	21	10 1/2	73 1/2	84
48"	12	18	27	12	84	90

Flared end terminal section to be included in length of pipe shown on plans.

All parts are to be galvanized in accordance with AASHO M 36.

Any areas where galvanizing is broken or metal is bare shall be painted with one coat of red lead or zinc chromate prime and two coats of aluminum paint.

Pipe end to which flared end section is to be fastened shall not be reinforced.

Minor variations in design will be acceptable, however the tolerances must not be exceeded. Seams or joints lengthwise of the apron will be acceptable if securely welded and painted as provided above.

The metal gages shall be the same as the pipe to which the section is fastened.

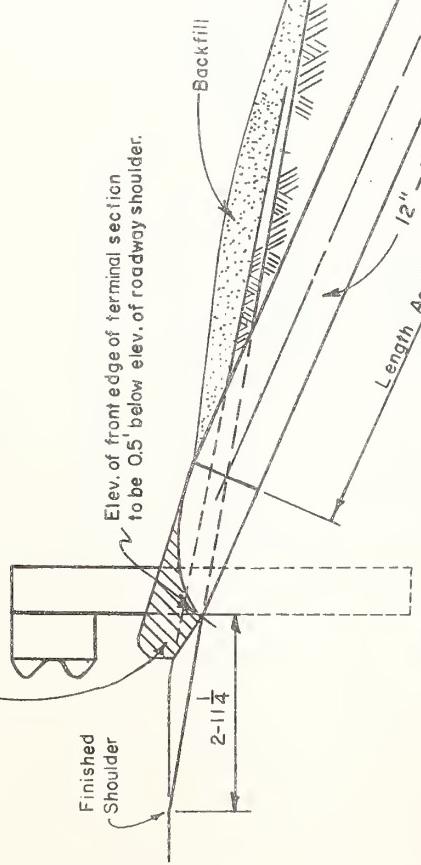
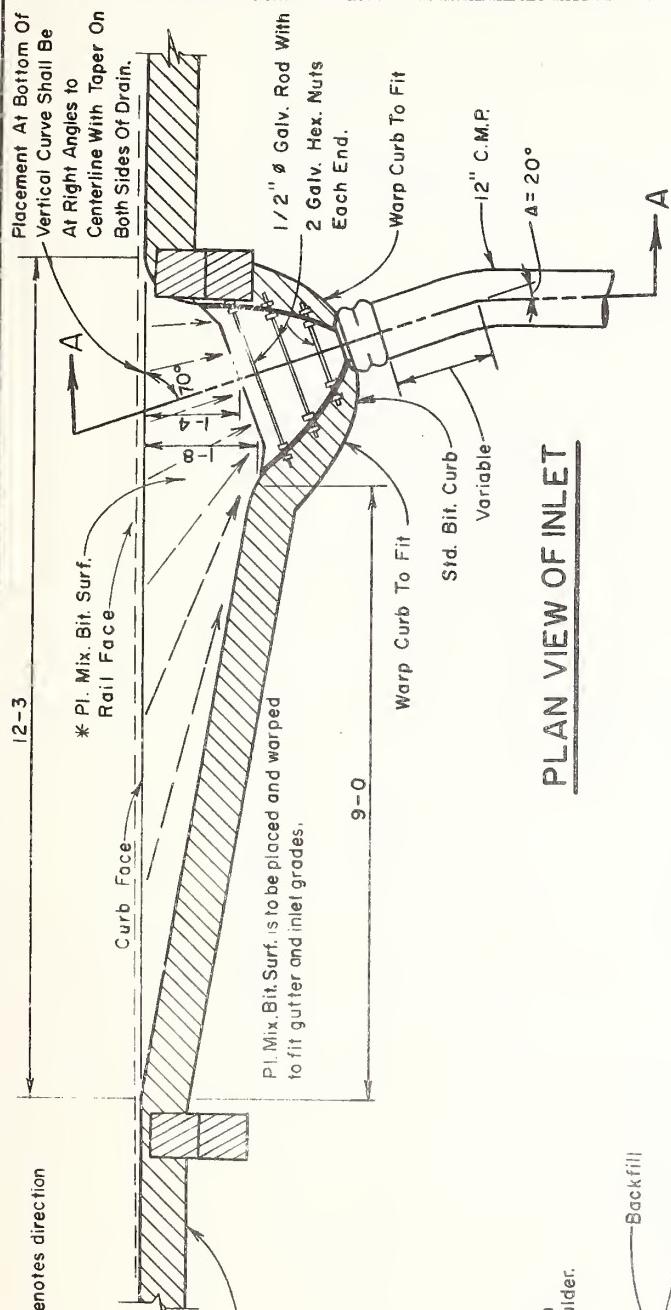
REVISED 9-17-68 11-1-68
EFFECTIVE 11-1-68 11-1-69

Standard Drawing No. 56-10

State Highway Commission
Helena, Montana

EMBANKMENT PROTECTOR

Approved 10-8-67
Lewis M. Collins
State Highway Engineer



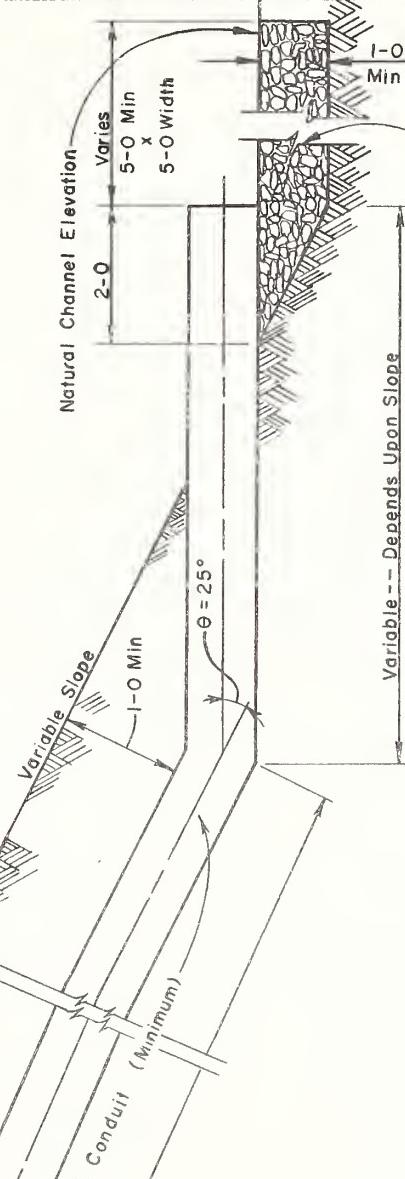
GENERAL NOTES

Conduit May Be Either Circumferential Or Helical.
 θ And Δ Shall Be As Shown Unless Otherwise Specified In The Plans Or By The Engineer.

Contractor Shall Not Order Pipe Until Directed By The Engineer.
Flared End Section May Be Called For On Outlet End When Specified On Plans.

Embankment Protector Shall Be Bid As Unit Price Bid Per Lin.Ft.
The 12" Flared End Section, 12" C.M.P. And Bends, Are To Be Included In Total Length Of Embankment Protector.

All Other Hardware Shall Be Included In The Unit Price Bid Per Lin. Ft. Of Embankment Protector.
* Included With Roadway Quantities.



Approx. $1\frac{1}{2}$ Cu. Yd. Type 3 Bank Protection - To Be Placed In Manner Best Suited To Fit Existing Conditions.

OUTLET DETAIL

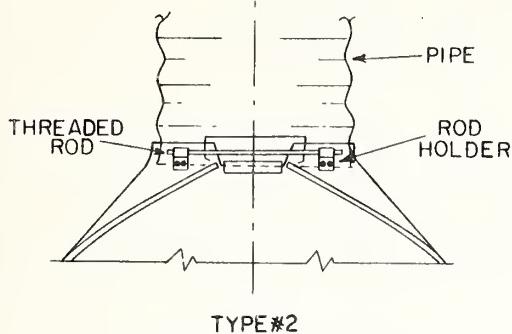
REVISED 1-1-64 11-20-68
EFFECTIVE 1-1-64 1-1-69

STANDARD DRAWING NO. 57-02

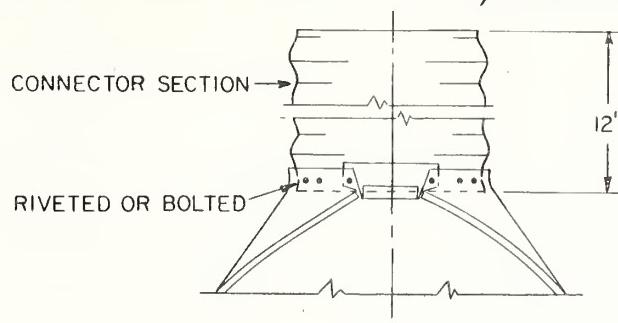
State Highway Commission
Helena, Montana

FLARED END TERMINAL SECTION
CORR METAL PIPE - ARCH CULVERT

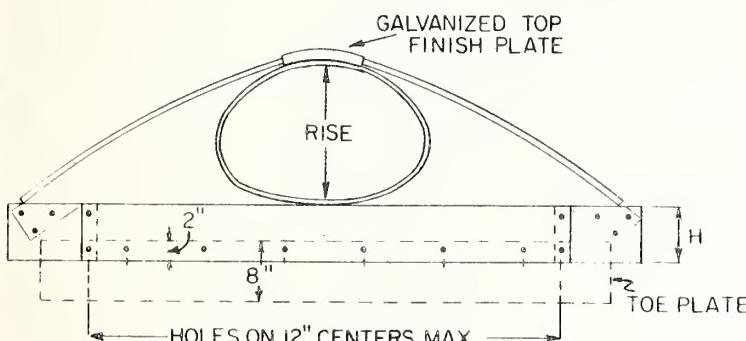
Approved
State Highway Engineer



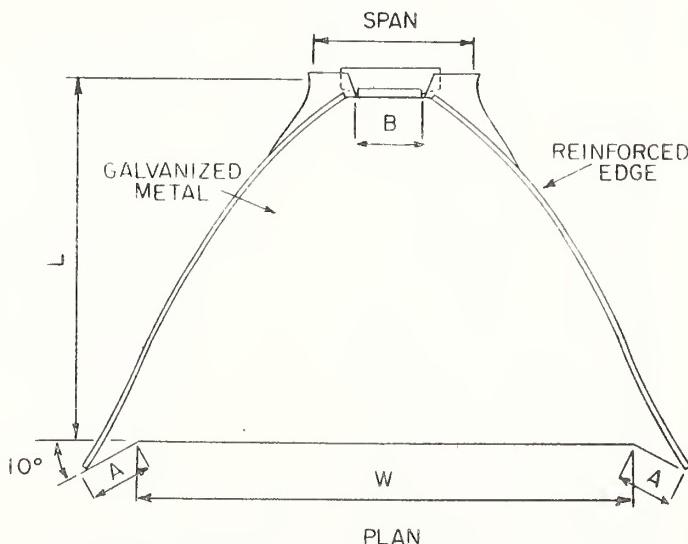
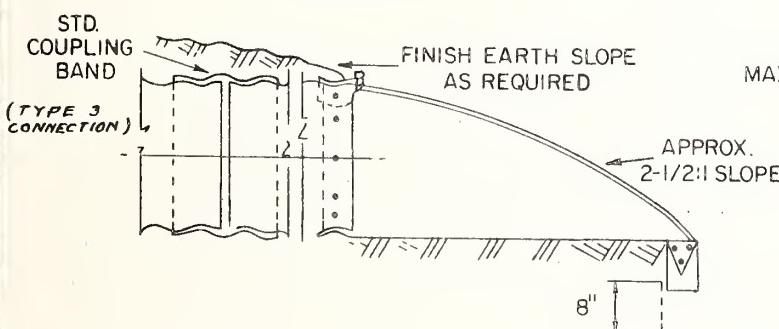
TYPE #2
STANDARD CONNECTION
FOR 18"X11" THRU 58"X36" ONLY



TYPE #3
STANDARD CONNECTION
FOR 65"X40" AND 72"X44"



ELEVATION



PIPE-ARCH DIMENSION	MIN. GA.	DIMENSIONS				
		A 1" Tol	B Max.	H 1" Tol	L 1½" Tol	W 2" Tol
SPAN RISE						
18 11	16	4½"	9"	6"	19"	30"
22 13	16	5¼"	10	6	23	36
25 16	16	6¼"	11½	6	28	42
29 18	16	7"	14	6	31½	48
36 22	14	8¾"	16	6	38½	60
43 27	12	10¾"	17½	7-5/8	47	75
50 31	12	12¾"	20	9-1/8	54	85
58 36	12	14"	26	10 5/8	63	96
65 40	12	15¾"	27	10 5/8	70	112
72 44	10	17¼"	28	12-1/8	77	128

Flared end terminal section to be included in length of pipe shown on plans.

All parts are to be galvanized in accordance with AASHO M 36.

Any areas where galvanizing is broken or metal is bare shall be painted with one coat of red lead or zinc chromate prime and two coats of aluminum paint.

Pipe end to which flared end section is to be fastened shall not be reinforced.

Minor variations in design will be acceptable, however the tolerances must not be exceeded. Seams or joints lengthwise of the apron will be acceptable if securely welded and painted as provided above.

The metal gages shall be the same as the pipe to which the section is fastened.



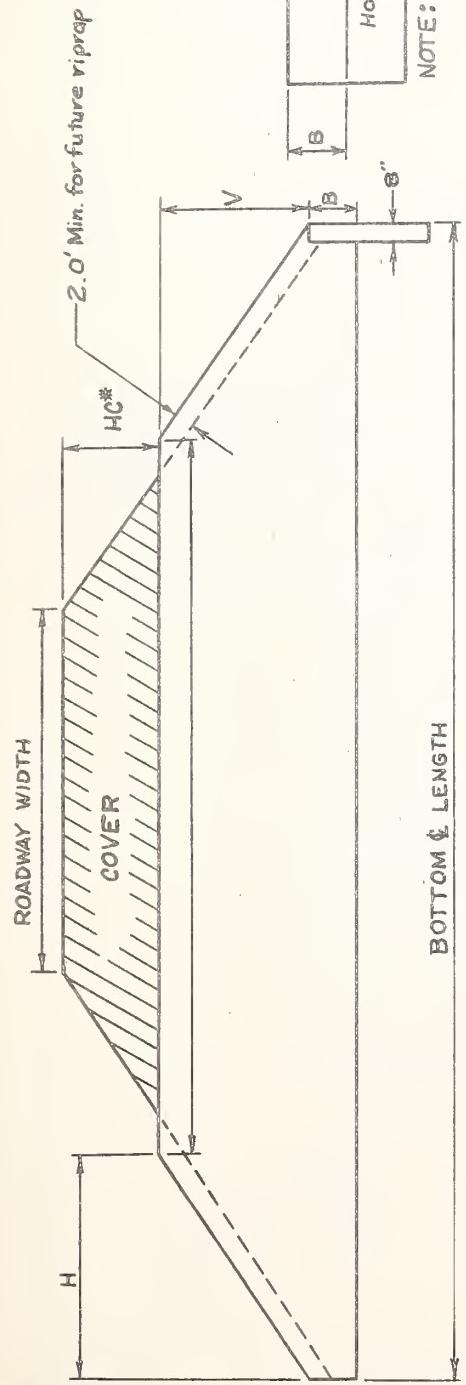
REVISED 8-1-67 11-20-68
EFFECTIVE 8-1-67 1-1-69

State Highway Commission
Helena, Montana

STANDARD DRAWING NO. 57-03

BEVEL ON CORRUGATED STEEL PIPE ARCH

Approved
Lewis M. Lutton
State Highway Engineer



BOTTOM & LENGTH

3 by 1 inch Corrugation

SPAN (Inches)	RISE (Inches)	EQUIV RIN FT FOR BEVELS OF 1/2 IN. CORRUGATION	Area 'A'
58	36	48	34 1/2
65	40	54	37 7/8
72	44	60	41 5/8
73	55	66	51
81	59	72	56 1/4
87	63	78	61 1/2
95	67	84	66 3/4
103	71	90	72
112	75	96	77 1/4
117	79	102	82 1/2
128	83	108	87 3/4
			117
			58 1/2
			24 1/2
			18.2

NOTE: For details, see Standard Drawing # 74-04A
covering Cutoff Walls.

Tolerance of $\pm 4\%$ will be allowed in all dimensions.

Use skew ends when skew is greater than 15° but not greater than 45° .

* HC : See Std. Dwg. No. 57-01

HC measured vertically from finished low shoulder to top of pipe.
If possible it is desirable that top of pipe be placed a min. of 1.0' below subgrade surface.

2 2/3 by 1/2 inch Corrugation

58	36	48	40 1/8	53 1/2	26 3/4	9 1/4	3.1
65	40	54	44 1/4	59	29 1/2	10 1/2	3.9
72	44	60	48 3/8	64 1/2	32 1/4	11 3/4	5.0
79	49	66	53 5/8	71 1/2	35 3/4	13 1/4	6.1
85	54	72	59 1/4	79	39 1/2	14 1/2	7.3

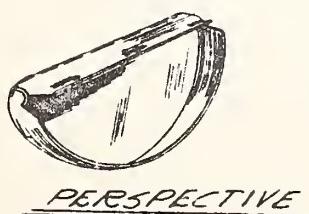
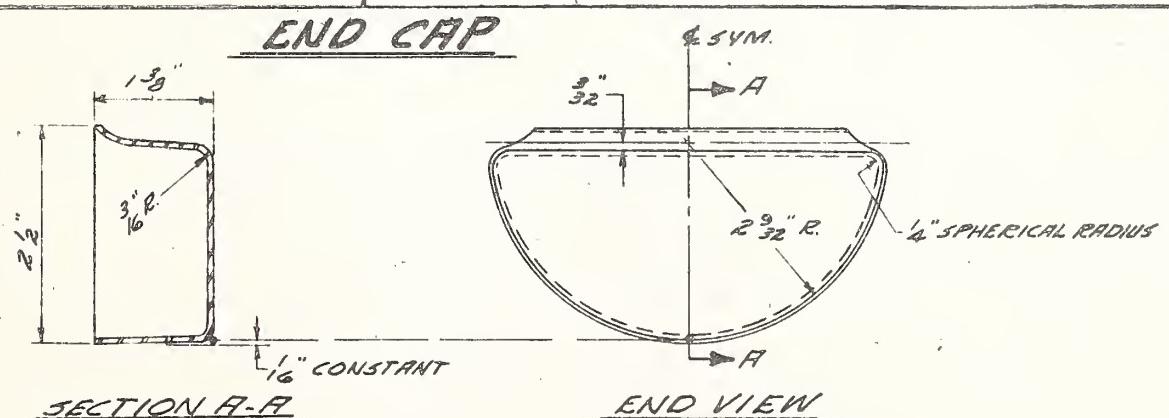
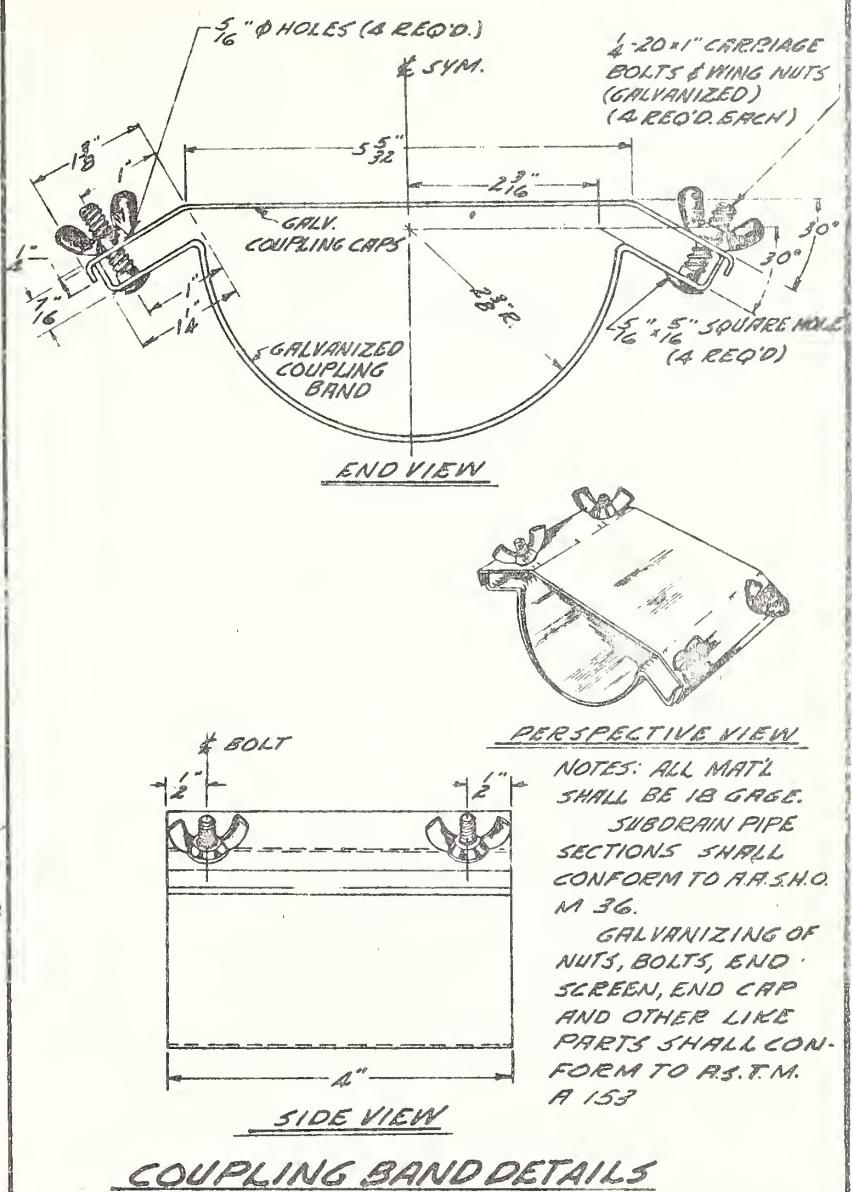
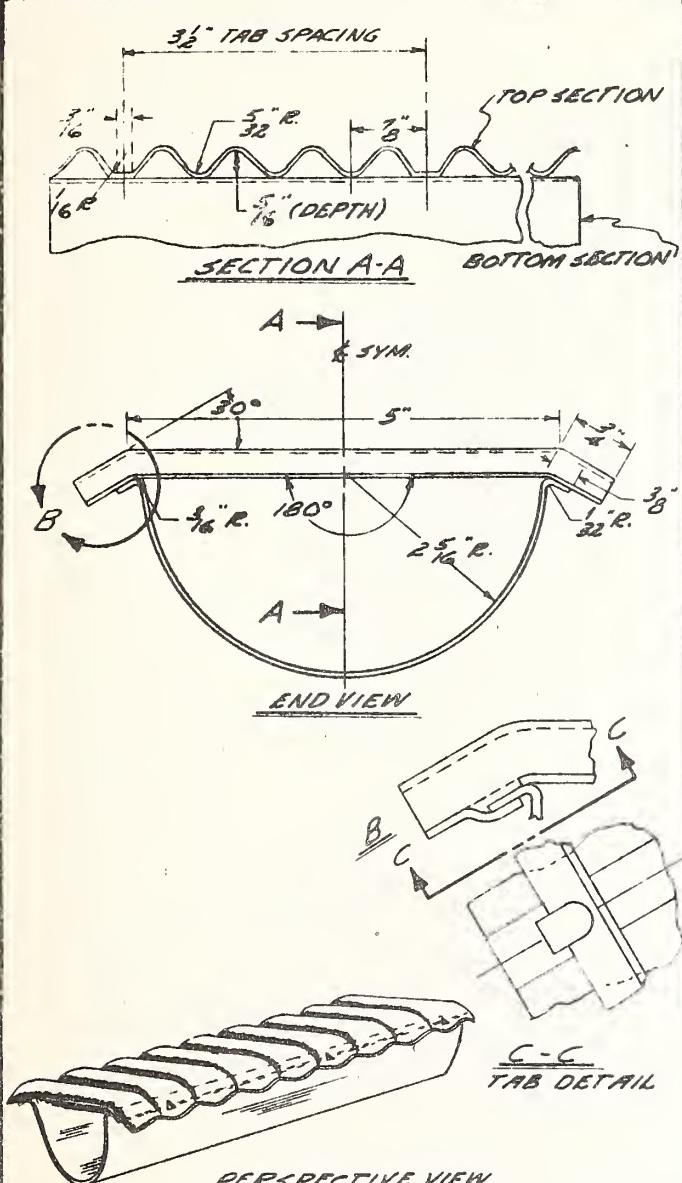
REVISED 8-1-63 11-20-68
EFFECTIVE 8-1-63 1-1-69

STANDARD DRAWING NO. 69-01

State Highway Commission
Helena, Montana

SEMICIRCULAR UNDERDRAIN

Approved
Lewis M. Shattuck 12-9-68
State Highway Engineer



NOTES:
MATERIAL TO BE 18 GAGE COPPER BEARING GALVANIZED STEEL.
END OF CAP TO FIT SNUG, WHEN INSERTED INSIDE END OF UNDERDRAIN.
TOLERANCES ARE $\pm \frac{1}{16}$ " EXCEPT AS SHOWN.
 $\frac{1}{2}$ " GALV. MESH SCREEN, SHAPED LIKE THE CAP, TO BE PROVIDED FOR EACH PIPE OUTLET.



Drawn 6-24-68

Revised
Effective 1-1-69

STANDARD DRAWING NO. 88-39

State Highway Commission
Helena, Montana

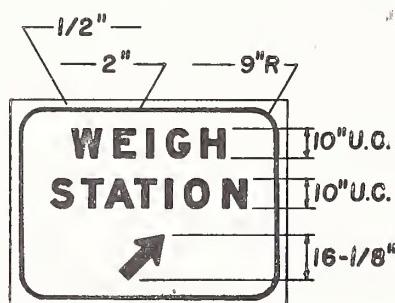
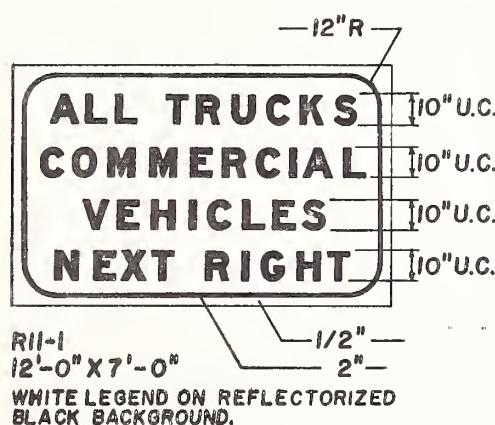
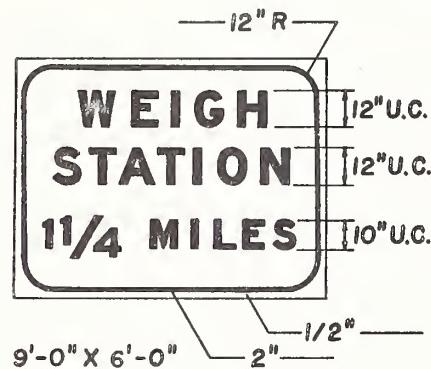
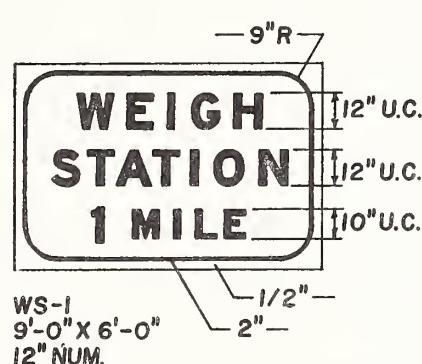
WEIGH STATION SIGNS

Approved

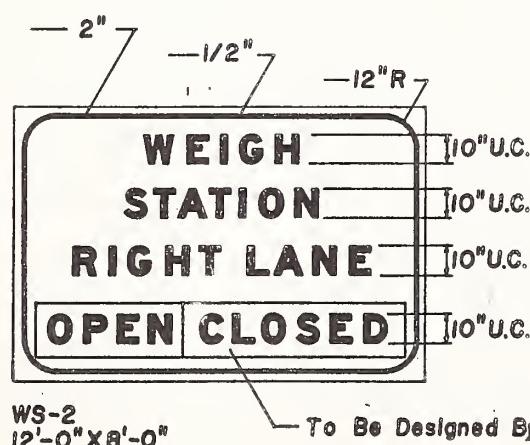
State Highway Engineer

NOTE.

WEIGH STATION GUIDE SIGNS SHALL HAVE WHITE LEGEND AND BORDER ON INTERSTATE GREEN BACKGROUND. LEGEND, BORDER, AND BACKGROUND SHALL BE REFLECTORIZED. TYPE A,B REMOVABLE COPY SHALL BE USED. (SEE STANDARD SPECIFICATIONS).



WS-3
8'-0" X 6'-0"
TYPE 'B' ARROW
14-1/4" X 17-1/4" AT 45°



Drawn 12-16-61

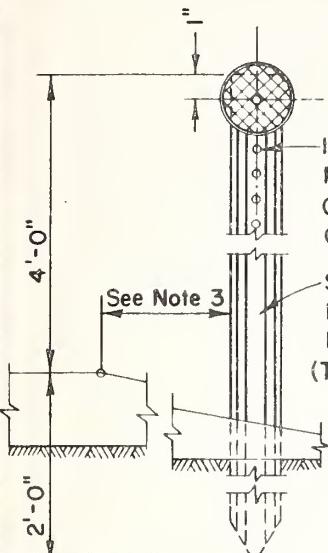
REVISED 11-1-68
EFFECTIVE 1-1-69

STANDARD DRAWING NO. 88-91

State Highway Commission
Helena, Montana

DELINEATORS

Approved

Lund or Shultz 12-16-68
State Highway EngineerDESIGN "A"
(CRYSTAL)Typical Use:

Interstate - Continuous along roadway.

Primary & Secondary - Where warranted.

DESIGN "B"
(AMBER)Typical Use:

All ramps and speed change lanes.

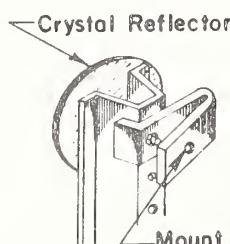
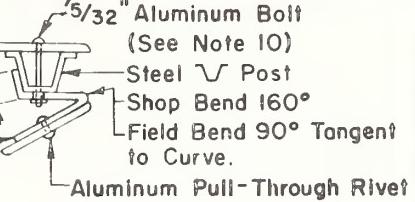
Special Use:

Construction zones or temporary connections, only as warranted by an engineering study.

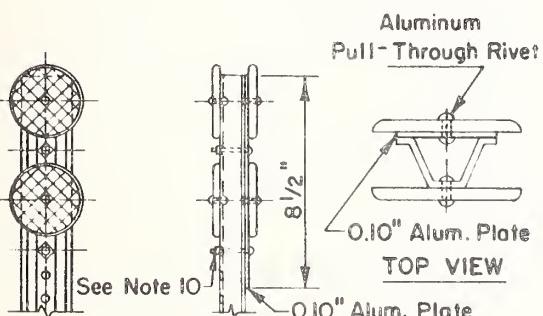
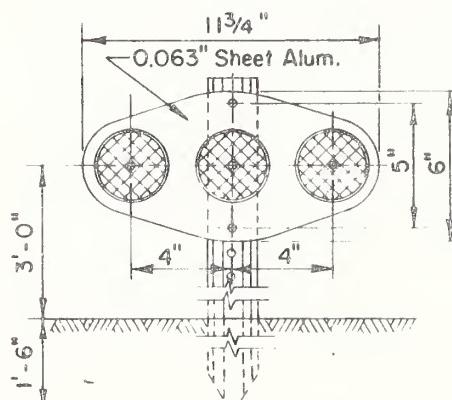
Lock Tab to keep Strap from rotating

1"X.063"X5 1/4"
Aluminum StrapAluminum
Pull-Through Rivet

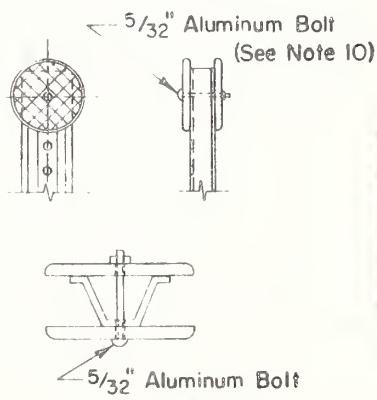
TOP VIEW

DESIGN "C"
(CRYSTAL, BI-DIRECTIONAL)
(ADJUSTABLE)Typical Use:

On curves sharper than 7°30' where necessary to aim delineator lens for full reflectivity.

DESIGN "D"
(AMBER, BI-DIRECTIONAL)Typical Use:Ramp terminus with crossroad.
Road approaches to major highway.DESIGN "E"
(AMBER)Typical Use:

Mounted in gore at exit ramps. At curbed nose of median or other channelization.

DESIGN "F"
(CRYSTAL, BI-DIRECTIONAL)Typical Use:

Tangent run-off in conjunction with Design "C". (See Std. Dwg. 88-92 and 7° and flatter.

NOTES:

1. Post type shall be as shown in DESIGN "A" for all designs.
2. Reflectors shall be center mount.
3. Post with delineators shall be placed facing oncoming traffic, 2'-0" clear from edge of shoulder or the face of curb, or as shown on plans.
4. Posts shall be driven, using an approved metal driving cap, prior to installation of the delineators.
5. All sheet aluminum shall conform to Standard Specifications.
6. For spacing of Guide Posts, see Horizontal Spacing Chart, Standard Drawing No. 88-92
7. On tangents, unless otherwise specified in the plans, the nominal spacing of Guide Posts shall be 264'.

Standard

8. Posts shall be installed behind guard rail posts where there is guard rail installed along the highway.
9. Where, under normal spacing, a delineator post falls within a crossroad, that post may be moved in either direction a distance not to exceed one quarter of the normal spacing.
10. 5/32" Aluminum Bolts of suitable length. Jam threads after turning nut tight to prevent removal. Rivet Delineators to plate prior to mounting.

DELINERATOR LEGEND					
—	TYPE A	—	TYPE D	—	TYPE E
—	TYPE B	—	TYPE E	—	TYPE F
—V	TYPE C	—	TYPE F	—	



DRAWN 3-15-67 REVISED 11-1-67 4-15-68
EFFECTIVE 8-1-67 EFFECTIVE 4-1-68 11-1-68

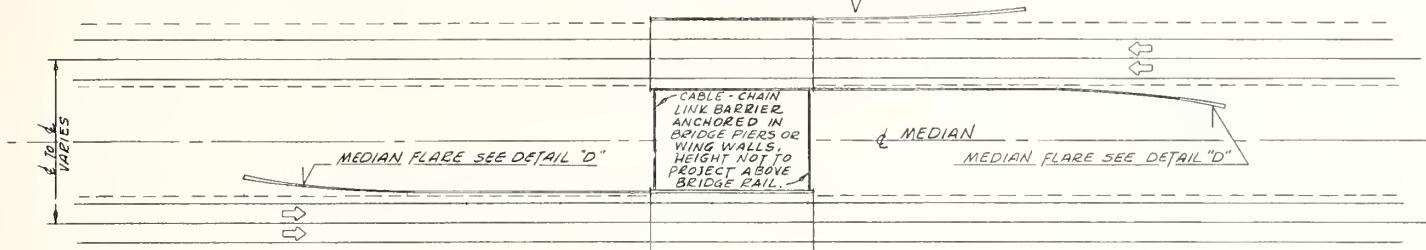
STANDARD DRAWING NO. 90-05

STATE HIGHWAY COMM.
HELENA, MONT.

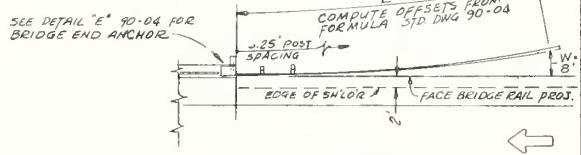
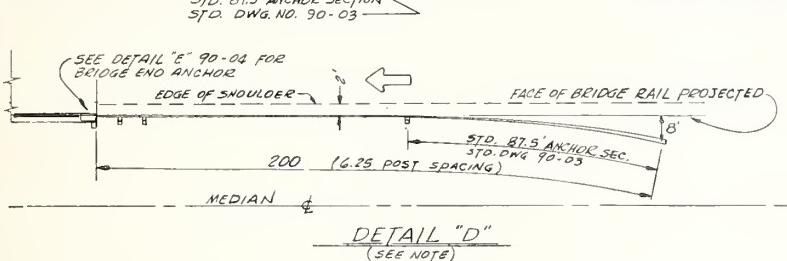
MULTILANE BRIDGE END & BRIDGE PIER
TREATMENT

APPROVED
Lewis M. Chaddess 7-18-67
STATE HIGHWAY ENGINEER

WHEN RAIL NOT CONTINUOUS SEE DETAIL "B"



WHEN MATCHING CONTINUOUS RAIL SEE DETAIL "C"



DETAIL "B"
(SEE NOTE)

NOTES -
ALL APPROACH BRIDGE ENDS REQUIRE FLARE & ANCHOR TREATMENT.
BRIDGES WITH FULL SHOULDER WIDTH REQUIRE A MINIMUM RAIL
TREATMENT OF 112.5' ON OUT SIDE SHOULDER & 200' ON MEDIAN SIDE.
FOR LESS THAN FULL SHOULDER WIDTH REFER TO STD. DWG. 90-04 CHART "A" OR "B"

SEE STD DWG. 90-03 FOR 87.5' ANCHOR SECTION NOTED IN DETAIL "D".

DETAIL "B", "C", & "D" - IF BRIDGE END ANCHOR POST IS NOT PROVIDED SEE
ALTERNATE 2 STD. DWG. 90-04.

SEE STD. DWG. 90-03 FOR DETAILS OF AP-1 CONCRETE ANCHOR, &
AP-2, AP-3, AP-4 STEEL BRACKETS.

SEE DETAIL "E" 90-04 FOR BRIDGE END ANCHOR



6.25' POST SPACING
100' MIN.

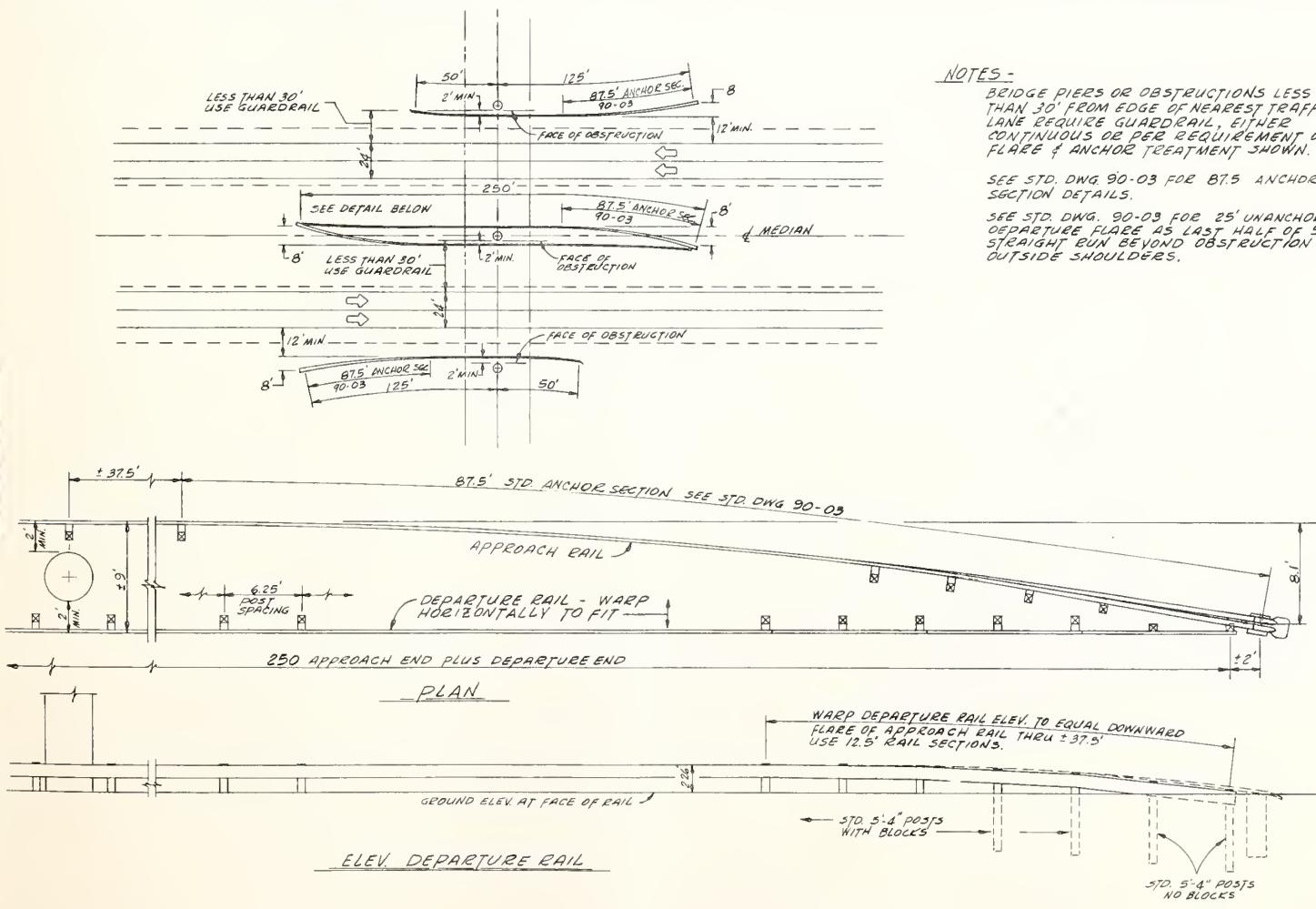
DETAIL "C"
(SEE NOTE)

NOTES -

BRIDGE PIERS OR OBSTRUCTIONS LESS
THAN 30' FROM EDGE OF NEAREST TRAFFIC
LANE REQUIRE GUARDRAIL, EITHER
CONTINUOUS OR PER REQUIREMENT OF
FLARE & ANCHOR TREATMENT SHOWN.

SEE STD. DWG. 90-03 FOR 87.5' ANCHOR
SECTION DETAILS.

SEE STD. DWG. 90-03 FOR 25' UNANCHORED
DEPARTURE FLARE AS LAST HALF OF 50'
STRAIGHT RUN BEYOND OBSTRUCTION ON
OUTSIDE SHOULDERS.



REVISED 6-1-67 11-1-68
EFFECTIVE 6-1-67 1-1-69

STANDARD DRAWING NO. 90-15

State Highway Commission
Helena, Montana

COMBINATION GUARD RAIL & HEADER

Approved 3/13/67

Louis M. Buttell
State Highway Engineer

